Toshiba and Einstein reviews

YOUR COMPUTER

85p

SEPTEMBER 1984

BRITAIN'S BIGGEST-SELLING HOME COMPUTER MAGAZINE

VOL 4 No. 9

HOW FRANKIE GETS TO HOLLYWOOD

Music and micros: two tribes in harmony



Spectrum Manic Climber

ZX-81 Sprites

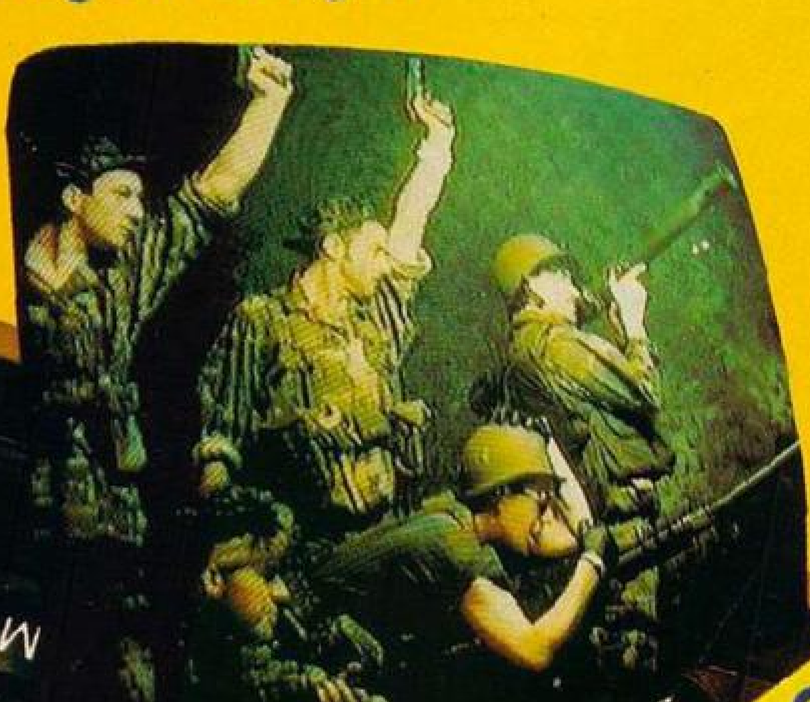
CBM-64 Bullion

BBC Backgammon

Amstrad Sky Drop

Hell's Bells and Filing for Dragon

Vic Robot Attack

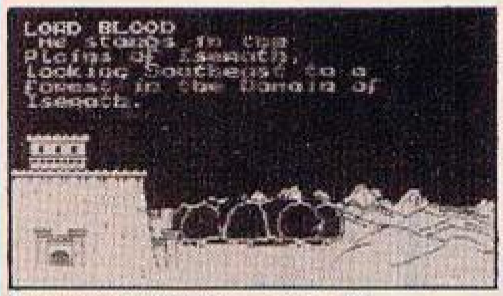


Three Psion Organisers up for grabs


KOKOTONI WILF
. 'Kokotoni Wilf is an arcade adventure whose undisguised intention is to steal the title of 'best arcade adventure program bar none' from Jet Set Willy'.
As Kokotoni Wilf you must recover all the pieces of the legendary Dragon Amulet (which has been scattered throughout time) for your master the great magician, Ulrich.
Throughout the quest Wilf comes up against many dangers from huge lumbering prehistoric dinosaurs, to hostile alien robots, but the reward for recovering all the pieces warrants the risk.
The 48K program features a number of major advances over Jet Set Willy. The games designer, Elite, stresses that each of the games 60 plus screen settings is genuinely high resolution, as opposed to psuedo hi-res, and doesn't require a title to explain what you're looking at. Furthermore, the sprite characters are of cartoon quality and exhibit their own personalities.
Impressive claims. Jet Set Willy fans will no doubt feel both sceptical and intrigued . . . . .
Watch this space!
48K Spectrum and Commodore 64
available Sat. 15th September.
elite

YOUR COMPUTER Contents

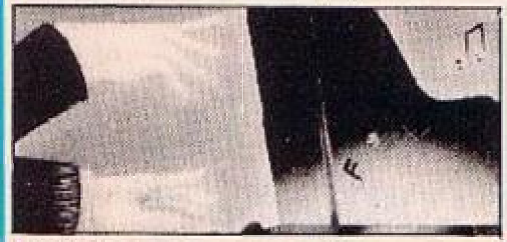
SEPTEMBER 1984



Software shortlist — page 43.



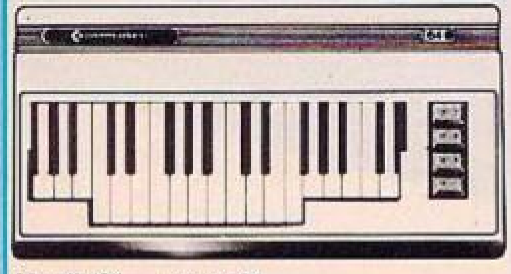
Toshiba HX-10 review — page 48.



Music hardware — page 65.



Frankie in Hollywood — page 75.



Musik 64 — page 80.

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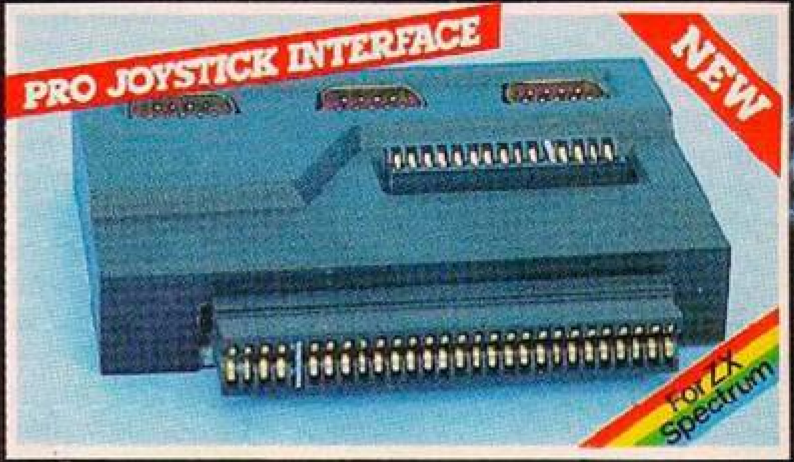
CPC 464 complete with monitor and datacorder



Peripheral perfection



No more fumbling with the game control keys, now you can have joystick control on the ZX Spectrum. The Kempston joystick interface allows all joysticks in the Kempston range (and others that are Atari compatible) to be used with the Spectrum. Simply plugs into the edge connector. No modifications necessary. **ONLY £11.50**



Compatible with ZX Interface 1 the Pro-Interface has three 9-way D Sockets. Two of the sockets allow compatibility with Sinclair/Psion software whilst the third offers the dual facility of both Kempston joystick software and cursor key software. The Pro-Interface also features a cartridge slot for ROM based software. **ONLY £19.95**



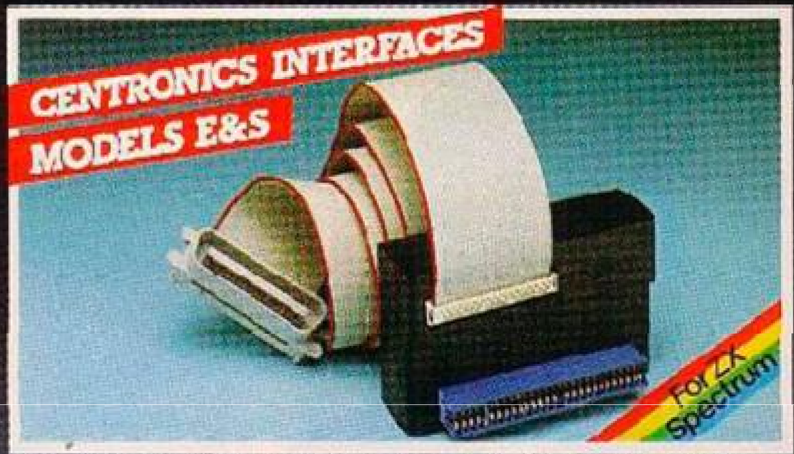
Maximum arcade quality features at a reasonable price. Features: □ Top fire button for one handed thumb control □ Trigger button for one handed index finger control □ Base fire bar for left or right handed control □ 8-way arcade quality leaf switches □ Rubber return action □ 1.5 metre cable. Commodore and Atari compatible. See joystick interface for Spectrum compatibility. **ONLY £12.75**



At last an RS 232 interface for the ZX Spectrum allowing connection to any printer which follows the RS 232 protocol. The interface has its own EPROM allowing the use of keywords LLIST, LPRINT and COPY. We recommend the Brother EP44 Printer for use with this interface. Interface complete with cable and connector **ONLY £45.00**



The ultimate joystick for the home computer. Features: □ Ergonomic design and nylon covered steel shaft □ 8-way arcade quality leaf switches □ Dual fire buttons for left or right handed play □ Rubber return action for smoothness □ 1.5 metre cable. Commodore and Atari compatible. See joystick interface for Spectrum compatibility. **ONLY £13.50**



The Kempston centronics interface will allow you to utilise a vast range of printers with an industry standard centronics input port on the ZX Spectrum. **Interface E** has all operating commands held in an EPROM, so plug in and its ready to use. **ONLY £49.99** **Interface S** offering similar features as above but software routines are provided separately to initialise the interface before use. **ONLY £35.00**

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The new Electron from Acorn. Ask any child at school why it's worth £199.

Most British children have one thing in common with the new Electron microcomputer: they speak the same language.

You see, the Electron is the first micro remotely in this price range to use BBC Basic, the computer language that is rapidly becoming the standard in British schools.



But that's not all. Most children will feel at home with the Electron as soon as they lay hands on it.

This is because it has developed out of the Micro that has been chosen by over 80% of schools participating in the Government's current Micros In Schools project. It has a similar keyboard and has most of the functions of this much acclaimed (but naturally, more expensive) machine.

So now children will be able to continue their computer studies at home. They'll be able to use the same educational programs they use at school. And, if asked nicely, they'll be able to help willing adults take their first steps into computing.

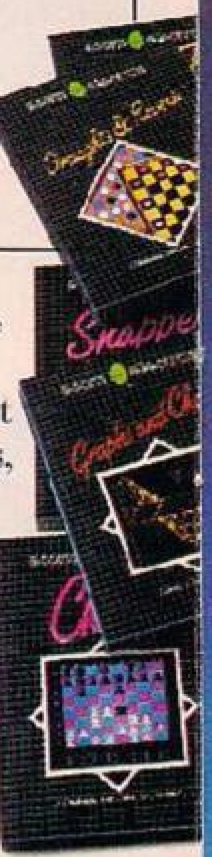
All this for only £199.

A micro technology break-through.

And now a few reasons for adults why the Electron is such an exceptional machine at the price.



The Electron is neat and compact. Yet it is fast and powerful. (Full details, for the technically minded, are in the box opposite.)



It produces high quality sound using its own internal speaker.

And it offers a range of facilities many larger more expensive machines just cannot match.

For example the Electron's colour graphics have the highest resolution of any home computer.

This is because the chip that controls the graphics, specially designed by Acorn, is one of the most advanced of its kind. As a result, the Electron delivers twice as many characters across the screen as its closest competitor.

Built to last and to grow.

The Electron has been designed and built to be a permanent part of the family, year in year out.

Particular care has been paid to the keyboard. It is electric typewriter style; robustly constructed with a good, solid 'feel'. It has a space bar, and single entry keys for key commands.

In other words it's comfortable and easy to use, avoiding the need for the manual gymnastics sometimes associated with calculator style keyboards.

And it will grow with you via expansion modules, that Acorn are developing, to take peripheral additions such as printers and disc drives. So as your knowledge, interest and ambitions develop, the Electron can develop with you.

Additionally, to give you all the support you'll need to generate your own applications software, we've established a phone-in service attended by specialists to give advice, encouragement and practical help.

A gentle teacher.

The Electron plugs straight into virtually any TV set and cassette player so you will be

ready to go as soon as you get it home.

It comes not only with a comprehensive user guide, which describes the machine and its functions, but also with a book that takes you step by step through the basic principles of programming.



A free taste of its versatility.

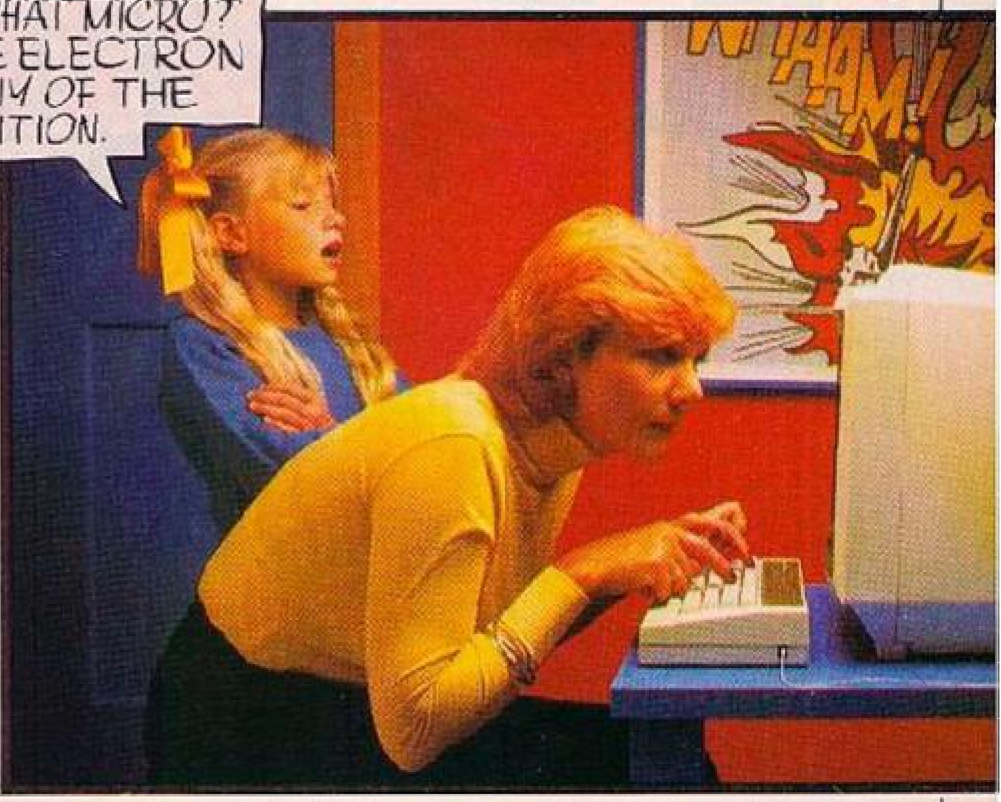
You will also receive an "Introductory" cassette which will put the Electron through its paces showing you a little of what it can do with its 64k of memory (32k ROM, 32k RAM).

The cassette will give you a taste of those exceptional colourgraphics we mentioned earlier; of its ability to play and notate music, and show you how it might help in home accounting. It will challenge you to a few games and will, if you ask it, do your whole family's biorhythms in a matter of seconds.

You will in short, through the 15 separate programs it contains, get a glimpse of the Electron's potential. But only a glimpse, for that potential is as limitless as your own interest and imagination.

A widening range of software.

To help you realise some of that potential, Electron software already ranges from "Personal Money Management" through "Starship Command" to "Creative Graphics" (which, incidentally, includes some spectacular three-dimensional rotating shapes). Naturally, with its strong educational links, educational software will be extremely



important for the Electron and even now O and A Level revision papers are being processed for Electron users.

How to get your Electron.

The Acorn Electron can be found at local Acorn dealers and major high street stores. However, if you would like to order one with your credit card, or if you would like the address of your nearest supplier, just phone 01-200 0200.

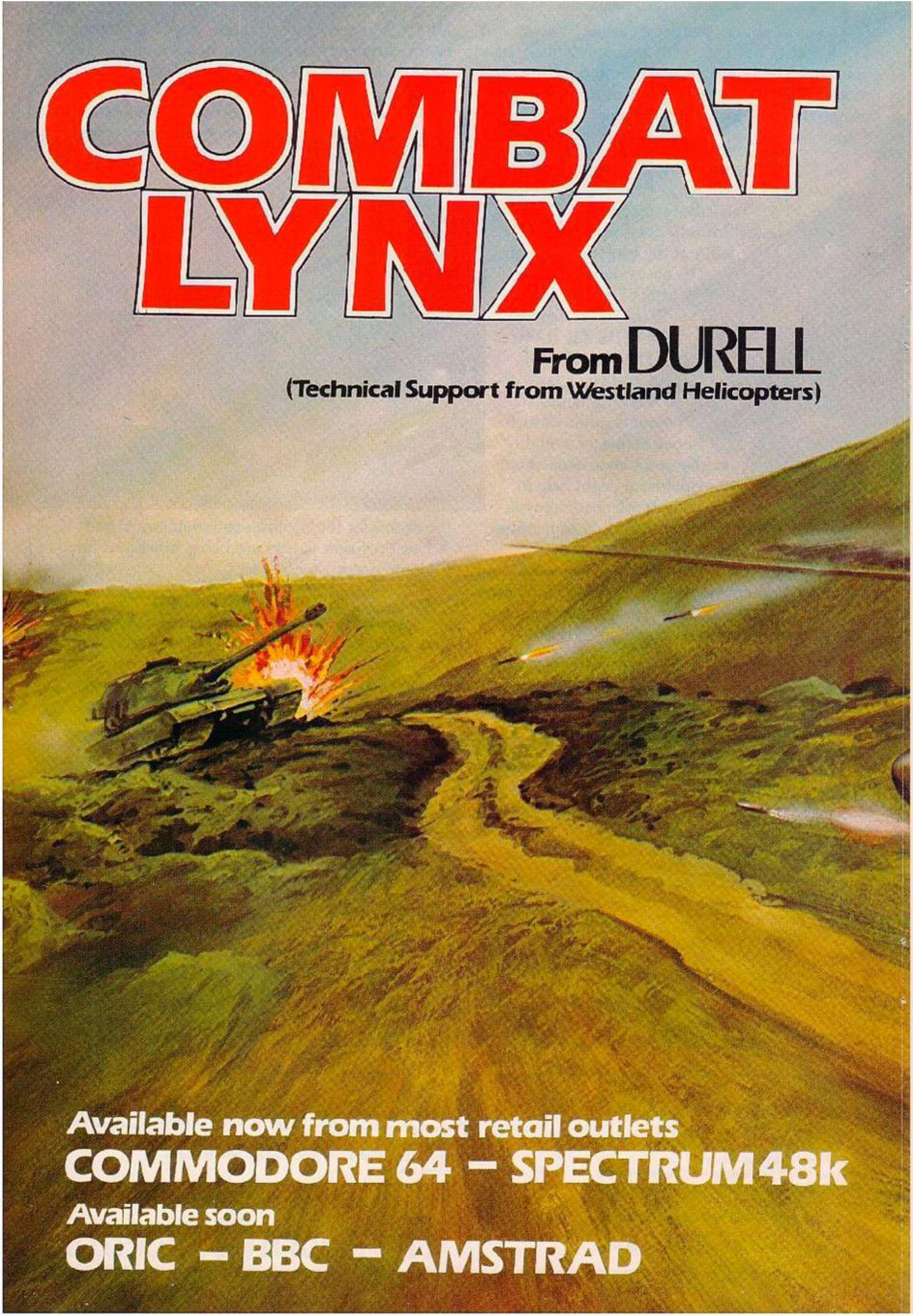


Technical Specifications

Hardware.
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Internal loudspeaker.
PAL UHF output to colour or black and white domestic TV.
RGB output for colour monitor.
56 key full travel QWERTY keyboard with spacebar.

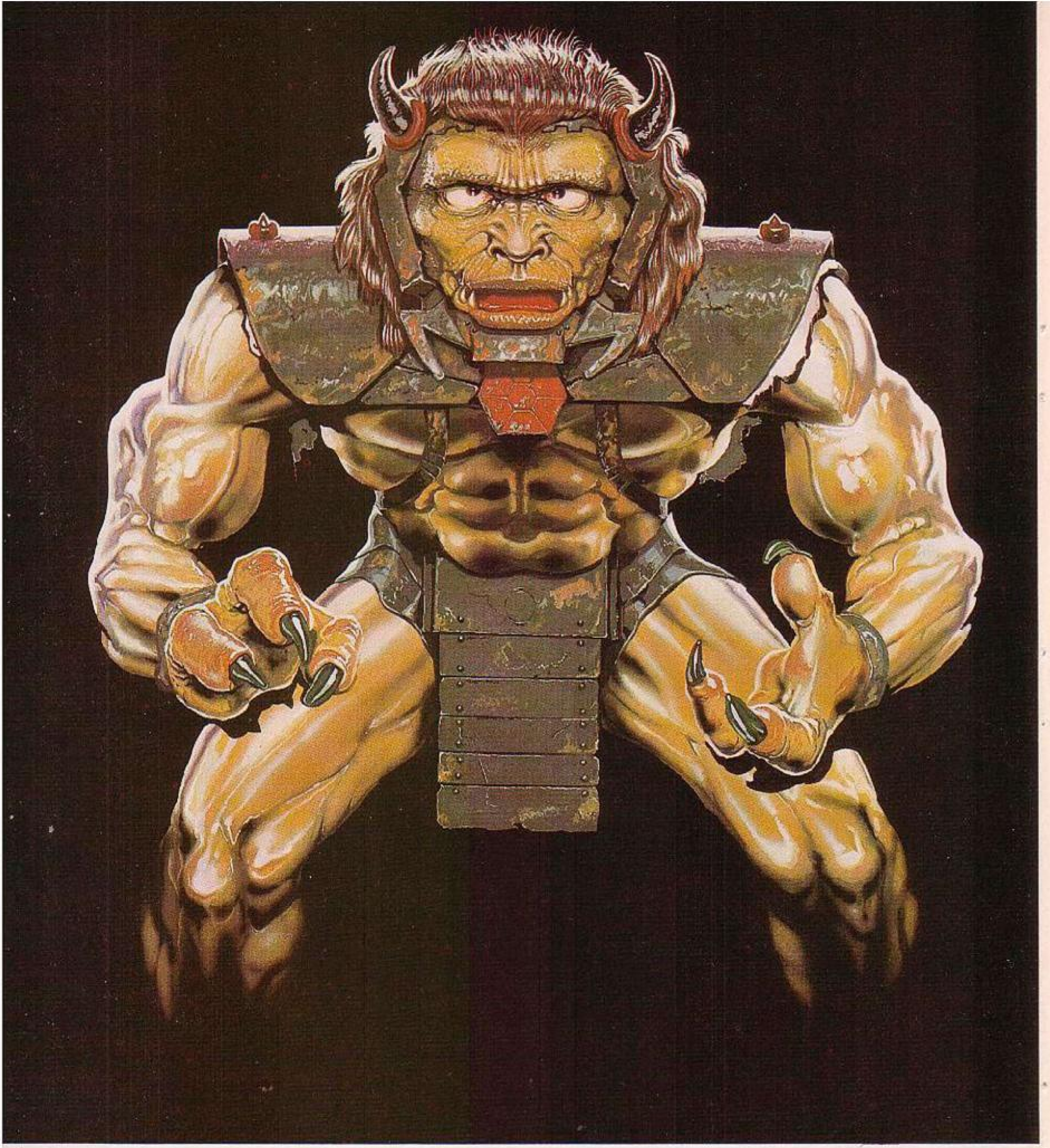
Software.
BBC BASIC.
Extensions include interger, floating point and string variables, multi dimensional arrays: IF...THEN...ELSE, REPEAT...UNTIL, procedures with local variables.
Operating system allows plot, draw and fill commands.
Event timing.
Built-in assembler.
6502 assembly language can be mixed with BASIC.

The Acorn Electron.



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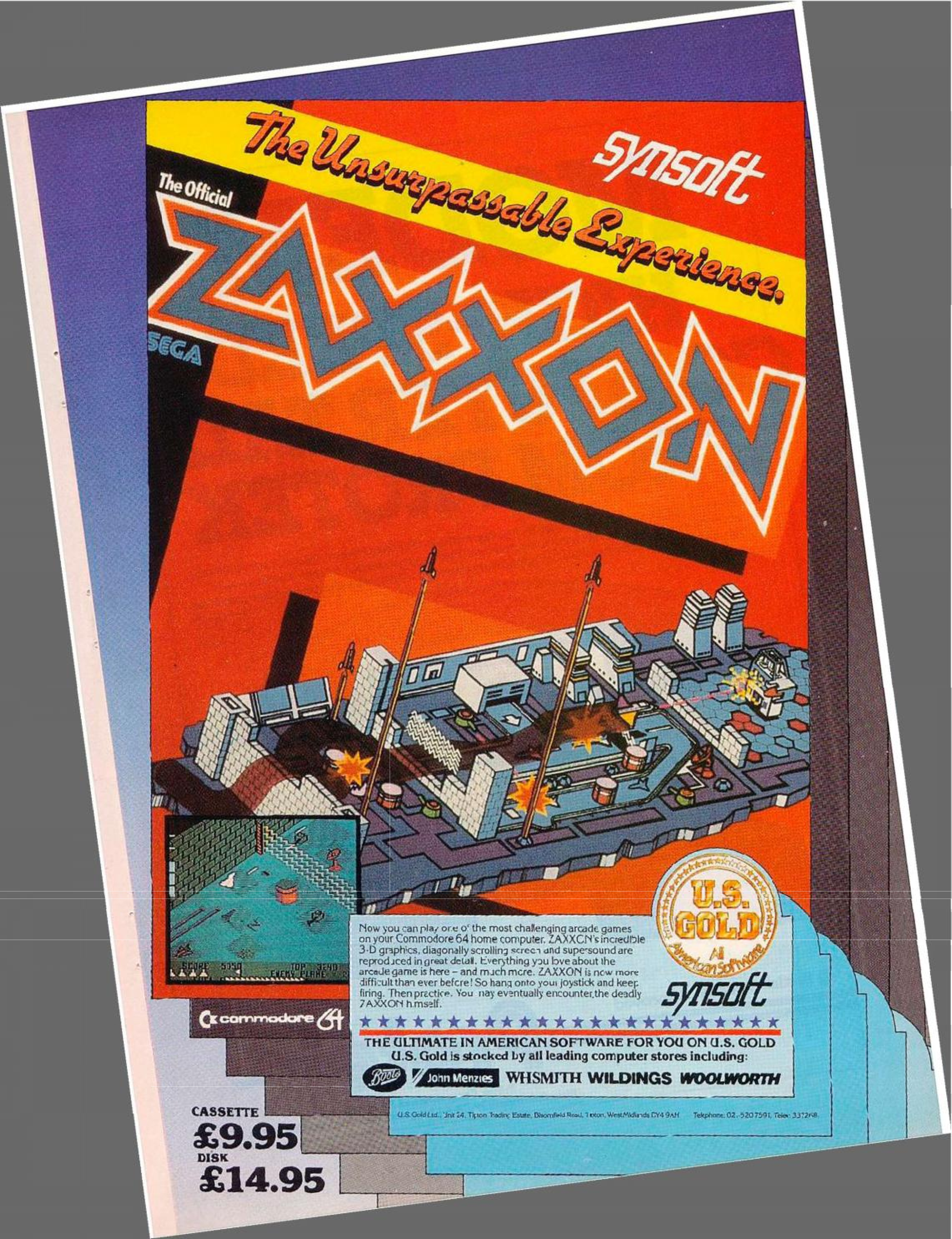






And with his help you may just escape from the 3-D horrors of the 1,000-chamber maze. DRAGON CAVES is one of over 130 different titles in the free colour catalogue for Sharp's MZ 700 series computer.

Software for the MZ 700 series ranges from the


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NEW RELEASES.

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Just listen to what the authors say – Simon, **"HATE IT"**. Graham, **"GAME WHAT GAME"** Rainbow Software were unavailable for comment...
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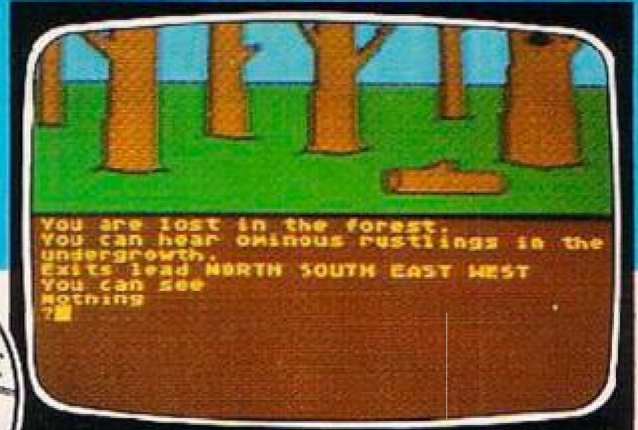
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'Stranded' by English Software. The challenge that's light years ahead.



Special Agent Sid's First Graphic Adventure

COMMODORE 64
ATARI 400/800
600XL/800XL
32K

Imagine you're Special Agent Sid of the SAS. The year is 2510 AD and you're marooned on a strange planet.

Getting home is the challenge to you from English Software! And 'STRANDED' is the name of the game.

It's Sid's aim to find his starship and return home safely. But not before he's encountered and defeated all the hazards of this lonely, unfriendly planet. And with over 35 graphic screens, that's quite a tall order.

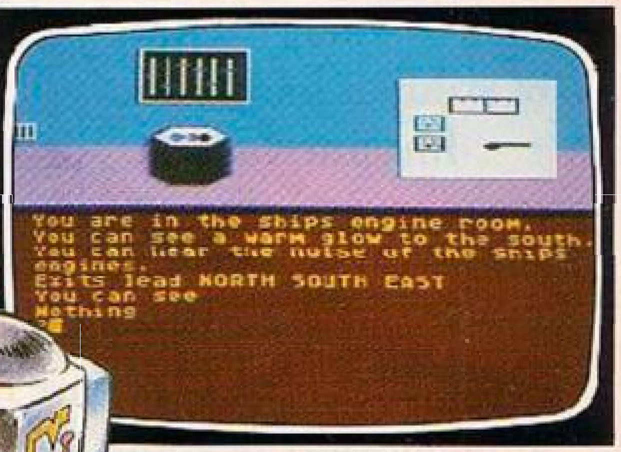
It could be a long mission – but we know you'll want to test your skills against everything that 'STRANDED' can throw at you.

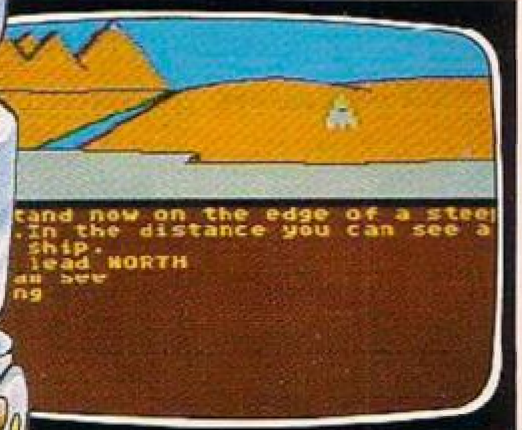
Written in machine code, game progress can be saved to cassette or disk.

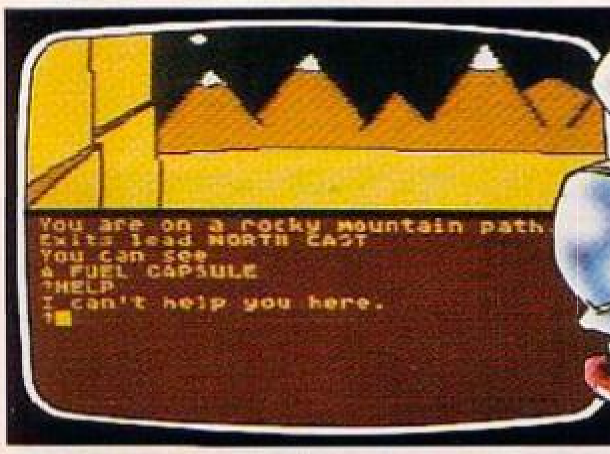
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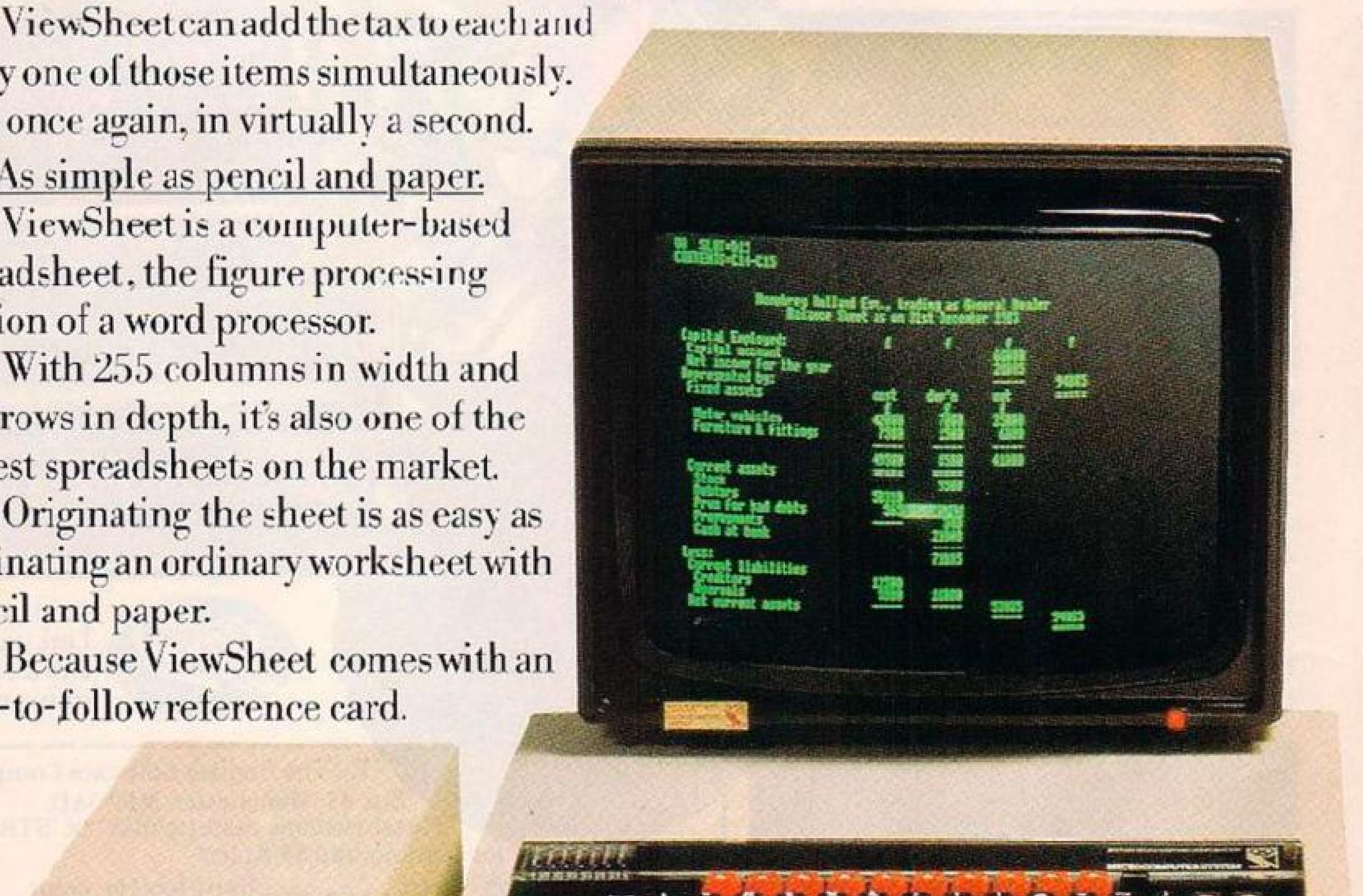
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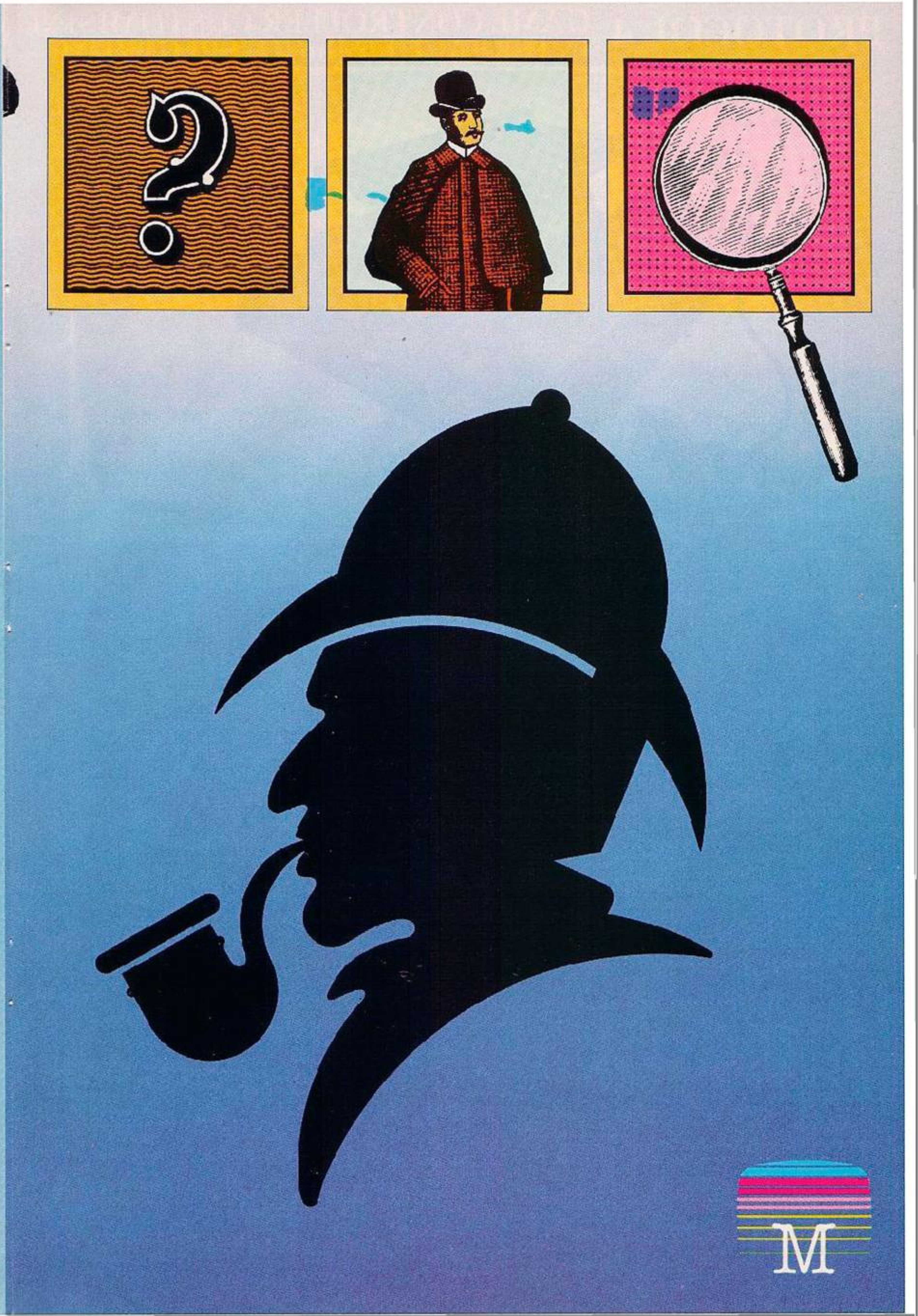
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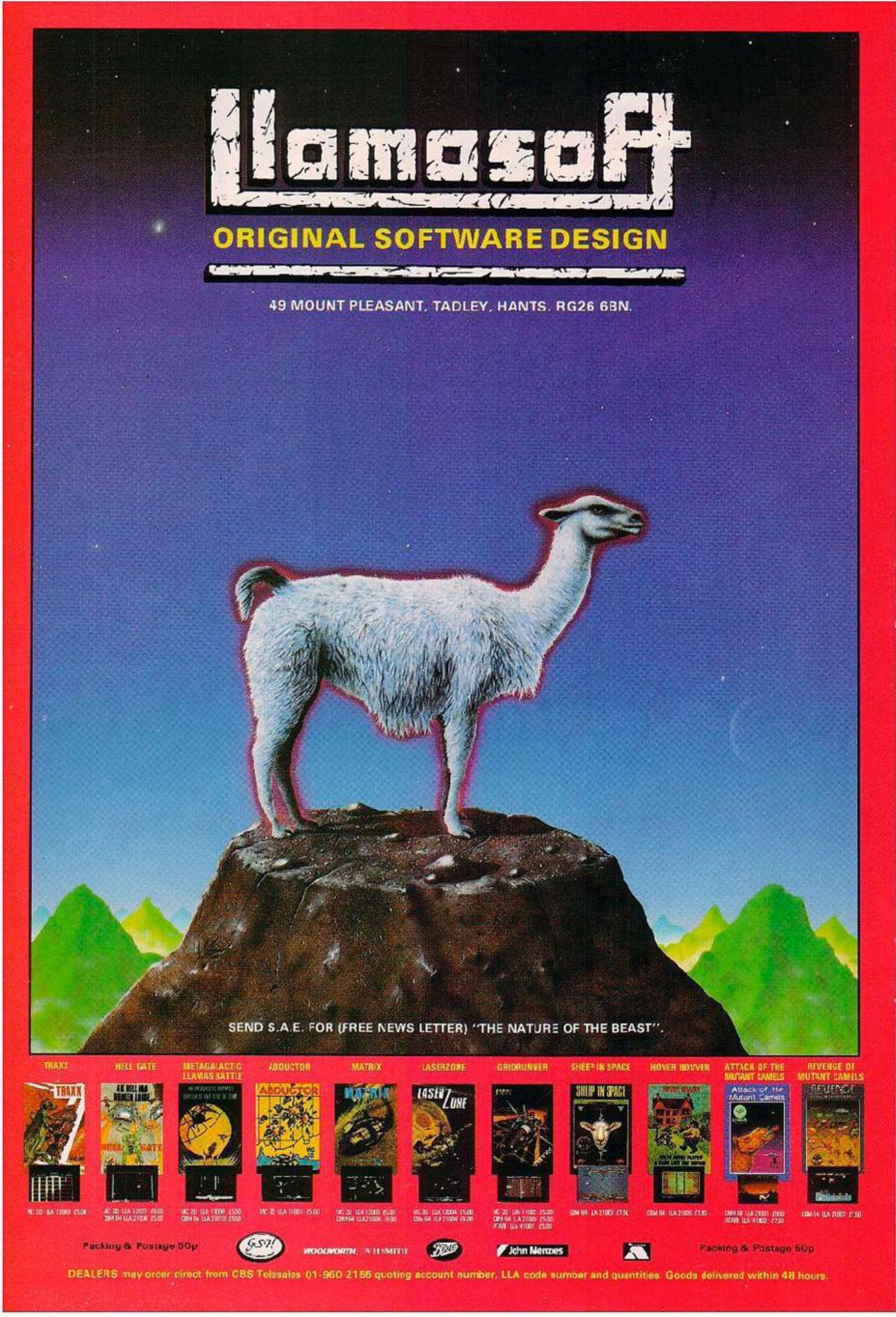
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LET AN EX-50 FIGHT FOR YOU



Oric-1 owners of the world unite — you have nothing to lose but your bugs!

If, like myself, you bought an early Oric-1, you will be familiar with the following scene: you've *finally* got *Zap the exploding serial attribute* to load. Through the haze of colour crawl, you go straight for the "sound effects loud" option. As the first alien gingerly floats across the screen, you eagerly hammer away at the spacebar, only to see the display ping its way into obscurity, and the alien shuttle sideways with its tentacles over its ears.

Before you can say "verify", the move-left button has stuck and the poor old 6502 has ducked under its shell like a One-Gun Turtle. With a sigh, you take out your pen and start another letter of complaint to Oric, consoling yourself with the thought that at least you'll get a free issue of *Oric Owner* out of it.

For a year, this is how my hobby went. But then, something snapped. No, not the power supply cable, my patience. Armed only with a Form EX-50, free at any county court, I sued Oric for a refund on the grounds that it was a faulty machine which did not live up to the advertising. Within a few weeks, I was cashing a cheque after Oric made an out-of-court settlement.

After my experiences, I do not think I'll invest in an Atmos. However, if that had been my choice, I certainly found a much cheaper way of going about it than Oric's £60 upgrade. If other owners follow suit, this could prove to be very costly for Oric. Hopefully this will teach them a lesson, that they should not bombard the public with faulty and incomplete machines. I wonder if Clive Sinclair is reading this?

Peter Braham,
Wakefield,
West Yorkshire.

ZX PANEL

In the documentation of ZX Panel in the July issue, the final sentence in paragraph 4, page 124, should read "it is moved by typing shifted 6" referring to moving the register cursor.

Alan Lee,
Tring,
Hertfordshire.

BIPODS

The ZX-81 Bipods program in the July 1984 issue shows what can be done on what appears to be a very limited machine. However there was one small error which caused the program to crash every time that it was run: line 5 should be Rand USR 16595 instead of 16592. When this has been corrected the program will run correctly.

Another area in which improvement can be made is to set the high score to 000000 instead of 003780. This can be done by setting the bytes between addresses 17400 and 17405 to 19 decimal. I hope that you will continue to print programs for the ZX-81 as they are much appreciated.

Jonathan Casiot,
London SW18.

SAVING BLOCKS

Owners of MTX micros may be a little perturbed by the fact that they cannot save and load blocks of data due to the lack of Basic commands. This problem can be overcome by a short machine-code routine which can be easily entered using the resident assembler:

```
LD HL, START OF BLOCK
LD DE,LENGTH OF BLOCK
LD A,DATA1
LD (#FD68),A
LD A,DATA2
LD (#FD67),A
CALL #0AAE
RET
DATA1 = 0 FOR SAVE, 1 FOR LOAD
        OR VERIFY
DATA2 = 0 FOR SAVE OR LOAD,
        1 FOR VERIFY
```

J Mullins,
Leeds,
West Yorkshire.

WILLY CHANGES

If you did not particularly like Matthew Smith's sneaky random hazards feature in Jet Set Willy which pulverises you after a visit to the attic, and you want an easier route and easier game proceed as follows.

Rewind the Jet Set Willy tape, and

```
1 DATA 162,110,150,30,134,4,132,5,32,45,27,162
2 DATA 198,160,32,134,4,132,5,32,45,27,162,30
3 DATA 160,31,134,4,132,5,32,45,27,162,118,160
4 DATA 31,134,4,132,5,32,45,27,96,165,4,133
5 DATA 6,165,5,133,7,198,4,160,22,177,4,201
6 DATA 10,240,8,201,12,240,4,136,208,243,96,169
7 DATA 32,145,4,145,6,136,240,19,177,4,201,15
8 DATA 240,13,201,16,240,9,169,10,145,4,159,11
9 DATA 145,6,96,169,32,145,4,160,22,169,10,145
10 DATA 4,56,0,0,32,90,25,32,144,26,96,0
11 DATA 0,0,0,0,0,0,0,0,162,0,160,30
12 DATA 134,2,132,3,32,145,27,230,3,32,145,27
13 DATA 96,163,255,177,2,201,11,240,8,201,13,240
14 DATA 17,136,208,243,96,169,13,145,2,136,169,12
15 DATA 145,2,200,76,157,27,169,11,145,2,136,169
16 DATA 10,145,2,200,76,157,27,0,0,0,0,0
17 DATA 162,6,254,112,28,202,208,250,162,0,160,30
18 DATA 134,0,132,1,32,215,27,230,1,32,219,27
19 DATA 96,234,234,160,255,177,0,201,15,240,8,201
20 DATA 16,243,11,136,208,243,96,169,16,145,0,76
21 DATA 231,27,169,15,145,0,76,231,27,96,96,0
22 DATA 96,0,0,0,0
90 PRINT"█****JET MAN PART 3****"
95 PRINT"██PLEASE WAIT....."
100 FORA=6912TO7168:READN:T=T+N:IFN=0THENS=S+1
110 POKEA,N:NEXT
120 IFT<>23502THENPRINT"DATA ERROR":END
130 IFS<27THENPRINT"ZERO MISSING ERROR":END
135 IFS>27THENPRINT"TOO MANY ZEROS ERROR":END
140 PRINT"██NOW LOAD THE NEXT PART"
```

enter:

MERGE""

Press play on the cassette recorder Once the first part of the program has loaded, stop the cassette and enter:

CLEAR 32767
LOAD ""CODE

Start the cassette. After the main part of the program has loaded, enter:

POKE 60231,0
POKE 42183,11
POKE 59901,82
POKE 56876,4

If you would like to save the new version of Jet Set Willy, prepare a blank tape and enter:

SAVE "JETSET"LINE 10
SAVE "JSW"CODE 32768,32768

If not, to play the new version, enter:

GO TO 40

Remember when saving to change recorder leads.

Software Projects,
Walton,
Liverpool.

QUELLING THE QL BASHERS

One point overlooked by Kathleen Peel, and QL reviewers in general, is that QL machine code runs some two to three times faster than ZX Spectrum and other eight-bit CPU codes. Benchmark comparisons between one plodding Basic and another are as meaningless as comparing cars by their performance in first gear. Who needs to know? If you are talking speed, you are talking machine code, Forth or Pascal.

Now that the Sinclair bashing season is again in full swing, could I put in a plea for less cataloguing of bugs and more hard connector and interface layouts, interrupts, and documentation?

All computers have bugs and it takes more than a handful of reviewers to find them all. My own theory is that bugs exist in direct proportion to the complexity and versatility of the product. A near perfect computer would take so long to produce it would be obsolete before it hit the streets.

We now seem to be entering a new phase of computer journalism where computers are judged mainly on their freebie software. A case of "Never mind the hardware, just feel the programs". If Psion really has fallen down on the job, some other software house will be only too pleased to plug the gap with a superior and inexpensive product.

The Psion software should be seen for what it is, a plastic toy in the cornflake packet. Also, I cannot understand this fuss is about multi-tasking. You can do it on a ZX-81. If you run several programs, type, print, and Microdrive all at the same time, it will tie your brain in knots, and there would be no excuse to go and make a cup of tea, and have a good think. Multi-masochism I call it!

On a more optimistic note, the mind boggles at the market potential for software authors afforded by 125K plus, 16 bits, and user-friendly 68000 code. Let's face it, without Sinclair, many of us would be on the dole anyway, so why knock it?

Doug Boller,
London N5.

JET SET ERROR

My letter in the June edition about the Spectrum program Jet Set Willy contains a mistake. Line 25 should be at line 36. Also the letter implied that the Pokes at line 25 would get round the code-checking problem altogether. This is not true.

The Pokes will reduce the number of squares that the program chooses from 180 to 2. The two squares that the program will choose are B2 and C2. So all the user has to do is write down the code for the two squares and then he will not need the card.

Mark Sanderson,
St Andrews,
Fife.

ROM PEEKER

To me, half the pleasure of owning a computer is pottering about, Peeking into the ROM. I was much saddened on discovering that my latest pride and joy, and brand-new Amstrad CPC-464, was better protected than Colditz. Try as I might, I could not Peek into the ROM, and notes in the manual suggested that you could have access to such well guarded secrets as the operating system on paying the ransom for the Advanced User Manual — no doubt another £20.

Surely Mr Sugar you can take pity on such mere "Beginners" as I who have only owned three previous micros and yearn to know how we might examine his mysterious machine.

Matthew Leech,
Leeds,
West Yorkshire.

ATMOS SMASH

Here are some changes which allow my Oric Smash program published in the May issue to run on the Atmos.

First, type in the machine-code as normal then enter the following commands:

```
DOKE41583,64464
DOKE41647,6432C
DOKE41663,6432C
DOKE41679,6432C
DOKE42497,6427E
DOKE42509,6429E
```

Additionally, make line 10 of the screen-generating program read:

```
10DOKE634,48000:POKE638,28
```

Finally, a reassuring word for owners of the Atmos who keep on getting the Errors Found message when loading programs. It does not mean that there are errors in the program just that the volume is probably too high.

M Dunlop,
Buckfastleigh,
Devon.

CORRECTIONS

In the July issue the following two lines were left out of listing 1 for the Spectrum Beanstalk program:

```
1300 DATA 64,255,192,255,64,
     63,0,0
1500 DATA 1,3,7,14,28,56,112,32
```

The last eight lines of listing 3 for July's Vic program, Jetman, were missing. They are given above left.

EDITORIAL

The overcoated figure advances into the floodlights. He drops a package in the middle of the barren strip that separates East from West and turns back quickly towards the barbed wire, the dogs and the Kalashnikovs. From the British side a representative of a leading U.K. software house edges forward to retrieve the parcel that contains the latest computer game written by his Warsaw Pact contact.

Not a setting for a new Cold War arcade game. In fact relations between British software companies and Hungarian programmers are particularly warm and cordial. Many of our firms have been reversing the controversy over technological exports to the Eastern Bloc by importing games software from behind the Iron Curtain.

In an attempt to inject some new life into a U.K. software scene which is rapidly running dry of original ideas, program publishers such as Virgin Games, K-tel, Ocean, Mirrorsoft and PSS have looked abroad. Perhaps because Hungarian programmers have not been subjected to decadent Western influences their games writing seems refreshingly original if sometimes a little too relaxed. Chinese Juggler, Bath Time and Felix the Cat are some of the better-known examples of the Hungarians' skill.

This desperate search for originality is an admission of failure. Behind the bankruptcies and belt-tightening that have made this a black summer for the software industry lies the fact that computer owners have grown tired of being sold thousands of variations on the same program themes.

Piracy and the slack summer months may have taken the blame: the real culprit is the lack of genuinely new software ideas.

A survey of 12 to 17-year-olds by Gowling shows that they are becoming increasingly critical of commercial games. Arcade programs were all too similar.

One way out of the problem would be to make these programs more interactive so that the players could devise new variations of their own once the original structure became tedious. But that flexibility costs memory and many of the best games at the moment are already using the big-selling micros' memories to the full.

Over the last three years progress in software has been carried along on the back of the rapid development of new machines. Now that hardware innovation at the bottom end of the market has slowed to a trickle and the program writers' techniques push existing machines to their limits, imagination now seems to be the problem.

So, what new hardware could help them on? Larger memories and cheaper storage would be a good place to start but the real transformation will occur when the laser discs behind arcade smashes such as Firefox and Dragon's Lair become available to home micro users. The Japanese are already working on a single system which would incorporate laser data storage with video and compact audio discs.

Unless new software ideas come along soon computing will become a static fad and everyone knows that fads die. Locking the stable door and then shooting the horse is not the subtlest way of making sure that you keep your audience captive.

How to write for *Your Computer*

We called this magazine *Your Computer* precisely because we welcome your views, tips and hints and even your criticism of machines and software in general. If you would like to see your name in print, whether on a Software File program or a full-blooded article, here is how to go about it. Ideally, all articles should be typed double-spaced on one side only of uniform sheets of paper. If listings can be dumped directly from a printer — you can always use a friend's or user group's — this minimises the risk of error. In a perfect world a cassette would accompany the article. That considerably speeds up the checking process. Not only do you get to air your own discoveries and opinions, but we will even pay you for the privilege. We pay £35 per published page — that's as it appears in the magazine and includes illustrations.

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Stranglers search for an ear in an Aural Quest adventure



THE STRANGLERS become the second bunch of punks from 1977 to stick a computer game on their new album. After Pete "Spiral Scratch" Shelley's XL1 now The Stranglers, are putting an adventure game for the 48K Spectrum on Aural Quest, their new album which will be released in November.

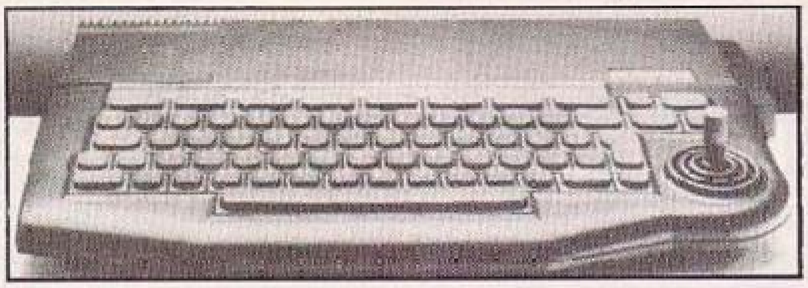
Dave Greenfield, whose keyboards on Rattus Norwegicus reminded so many people of The Doors, swops a piano keyboard for a Qwerty when he gets home and becomes a made keen adventure player.

The game on Aural Quest will be search for pieces of the ear with bursts of Stranglers music and lyrics providing some of the clues. Mike Turner of Star Dreams wrote the program using Gilsoft's Quill — a sausage machine for making instant adventures.

YOUR COMPUTER TOP 20

Game	Company	Machine
Arabian Nights	Interceptor	CBM 64
Beachhead	US Gold	CBM 64
Blue Thunder	Foundry System	Spectrum
Cuthbert in the Jungle	Microdeal	Dragon
Decathlon	Activision	CBM 64
Football Manager	Addictive Games	BBC
Fortress	Amcom	BBC
Frak	Aardvark	BBC
Hulk	Adventure International	CBM 64
Jet Set Willy	Software Projects	Spectrum
Lords of Midnight	Beyond	Spectrum
Matchpoint	Psion	Spectrum
Mugsy	Melbourne House	Spectrum
Sabre Wulf	Ultimate	Spectrum
Squirm	Mastertronics	CBM 64
Sub Commander	Creative Sparks	Vic 20
Tornado Low Level	Vortex	Spectrum
Trashman	New Generation	Spectrum
Zaxxan	Starzone	Spectrum

The search for the Enterprise — mission accomplished



ENTERPRISE computers may be in the shops by the end of September according to marketing manager Mike Shirley. "Unlike the others" says Mike "we're not making any silly claims." Enterprise should certainly know about silly claims — in September 1983 when the Enterprise then calling itself the Elvan was launched the company claimed that the first Enterprises would be in the shops by April 1984.

Mike Shirley says "There's no product that's come out in the last 12 months which puts us in the shadow."

GEOFF HOLLINGTON who featured in our January 1984 issue as leader of the external design team for the Flan — sorry, Enterprise — has not been idle as he waited for his creation to finally go on sale. He has designed an infra-red joystick for the Spectrum which does away with the need for wires. The stick will be sold by Cheetah.

Dragon alive but in Spain

DRAGON DATA just lost the race to develop urgently needed new products before the company collapsed. While new machines including Dragons with built-in disc drives and OS-9 operating system were being demonstrated at shows in London over the summer the Receiver was on his way in. Now a Spanish firm, Eurohard SA, already producing Dragon components has bought Dragon for a million pounds and will start production in Spain this autumn.





Dreams are made of this

ELECTRIC DREAMS is a simple tale of boy meets girl, boy meets computer, computer meets girl but the production company Virgin Films, "You've bought the record, you've flown the airline, you've pirated the computer game now see the film" sees it as a story fit for our epoch.

"Gone with the Wind added romance to the depression-defeated 30's. John Wayne's pugnacious patriotism reflected the war-torn 40's. Doris Day and Sandra Dee movies symbolised the innocence of the 50's. While Woodstock and Easy Rider caught the beat of the 60's, Star Wars and Raiders of the Lost Ark delivered the heroes missing in the real life of the 70's. An apt film for the mid 80's is Electric Dreams, a contemporary fairytale about a computer who falls in love." Try telling that to the average ZX-81 owner.

Big in Japan isn't big enough for Sega the Tokyo-based video games company which is now trying to find an importer for its SC-3000 home computer in Britain. The 32K machine has a real keyboard and cartridge slot with a price tag of £150.



More new ROM antics

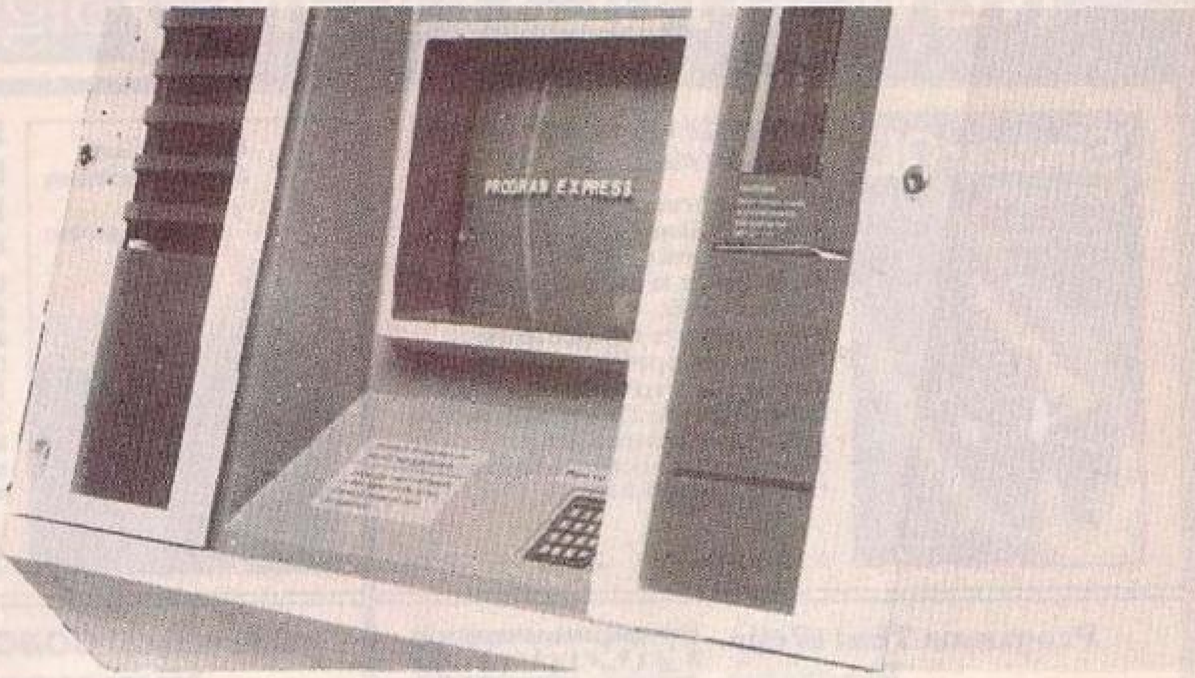
SINCLAIR ARE NOW SENDING ROM refit vouchers to all customers who have received the early EPROM QLs with FB, PM or AH operating systems. Those very early customers with FB or PM versions must also return the software package for an upgrade.

A prepaid parcel label is supplied and a turn round time of 10 days of receipt at Camberley is promised. In order to achieve the fast turn round, customers may not receive back their own machine but the guarantee period will commence from the time of the ROM upgrade. A Sinclair spokesperson said those customers who would find it difficult to be without the QL for a short period of time could apply for the ROM set in lieu, each case would be treated sympathetically.

The QLs will be given the JM ROM set which is AH with what is described cosmetic change to tidy things up. For those still unaware of the JM bug state, the major problems are Pi, which causes overflows on some 0° and 90° trigonometric calculations. Solutions use Rads instead, and the RS-232 interface where there appears to be a timing problem with many of the other less expensive printers which do not work with the QL.

The one that got away

IF YOU ARE still looking for the August issue of *Your Computer* it seems only fair to tell you that there wasn't one. We weren't on holiday but on strike. Subscribers will have an extra issue added on at the end of the year.



The vending machine with a difference

THIS IS WHAT the software shop of the future may look like if Program Express has its way. Eventually you could see them on street corners like cash vending machines outside banks although the first units are being installed inside branhces of John Menzies. Each unit has a stock of blank cassettes, cartridges and floppy discs and a telephone link to a central computer which stores the programs.

You just ask for the game or piece of business software you want and the shop assistant runs off a copy for you. The claimed advantage is that the shop can never run out of stock.

Pools fortune hunters

HARTLAND SOFTWARE is kicking off the new season with a new BBC version of the football pools prediction program which has already sold well on the ZX-81 and Spectrum. Unfortunately, it does not include a database of this year's fixture list so you have to enter that yourself. Hartland is on 01-385 1939.

CRL's Magic Roundabout

BOING! said Zebedee, and well he might on finding out that Clement Chambers of CRL had signed up the Magic Roundabout along with Thunderbirds and Terrahawks. CRL has six full-time programmers including Richard Taylor who learnt his trade writing articles for *Your Computer* plus a large number of part-timers and freelancers.

The programs will be available this autumn — first on the Spectrum then on the Commodore 64. In Magic Roundabout Dougall has to build a house of sugar while facing raids by Ermintrude the cow, Mr McEnry and all the other characters. "Time for bed" said Zebedee BOING!

Cheap at the price

BARGAINS ARE THIN on the ground this autumn but some shops have been selling Dragons for as little as £90, Electrons for £170, and BBC Bs for £350. Ring up and tell us if you see any cheaper prices. Officially, Sinclair and Acorn are discouraging discounting but going for added value offers instead.

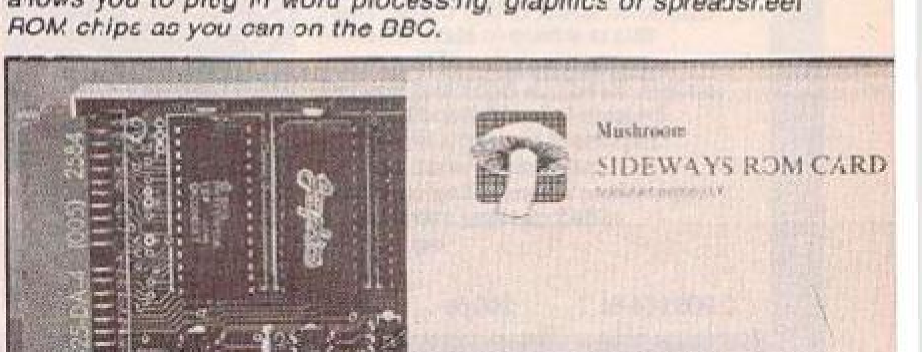
Sinclair is offering £56 of free software with every 48K Spectrum sold — and for once this includes some of the best programs around including Scrabble and Chequered Flag, Chess, Survival, Make a Chip and Horace Goes Skiing make up the rest of the bundle. Acorn is offering a free data recorder with five free programs with every BBC sold.

England search for fast bowlers spreads to Iceland

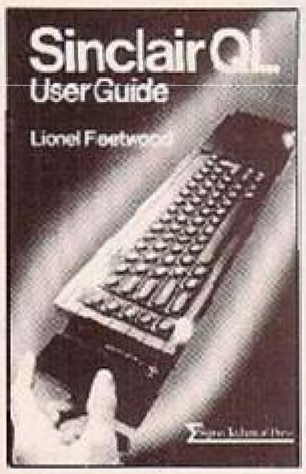


DESPERATE MEASURES are being taken in the wake of England's 5-0 drubbing by the West Indies. Peaksoft is expeorting Tim Love's Cricket for the Commodore 64 and Dragon to Iceland in the hope of encouraging the Norsemen to put together an Eleven which Gower and the boys would have a chance of beating. Aha you say if this is supposed to be Iceland why are there penguins running around in the picture? "The penguins" say Peaksoft "normally confined to the Antarctic, had escaped from Reykjavic Zoo."

The struggle to turn the Electron into a BBC continues with Broadway Electronics £30 Mushroom sideways ROM card. This allows you to plug in word processing, graphics or spreadsheet ROM chips as you can on the BBC.



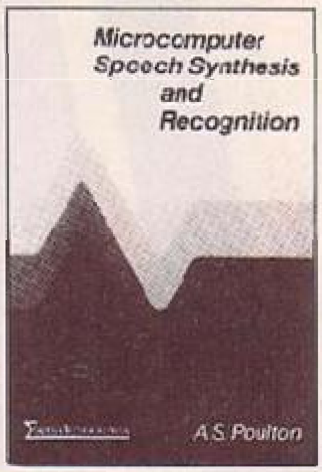
NEW TITLES FROM ∑Sigma Press



Sinclair QL: User Guide
by Lionel Fleetwood

Whatever your requirements, the Sinclair QL User Guide will help you to get the most out of your new purchase - or to decide if you should purchase a QL.
It shows how to produce letters, keep records, prepare accounts and draw useful graphs. Examples are drawn from real life and each section can be used independently.
Throughout the book the language is clear and jargon-free.

0 905104 92 7 180pp £7.50



Microcomputer Speech Synthesis and Recognition
by Adrian Poulton

Computerised speech synthesis and its counterpart, speech recognition, are emerging as one of the most important technologies of the mid-1980s. This book explains the origins of artificial speech and shows you how to make your micro speak to the world and how you can speak back to it!

0 905104 39 0 202pp £7.95

Programs That Write Programs
by Chris Naylor

In this thought-provoking book Chris Naylor explains exactly what a program generator is and exactly what it can and cannot do.
With the emphasis on the business user, he examines the situations commonly found in any programming project and shows the interaction between the problem to be solved and the software tools available to implement any solution.

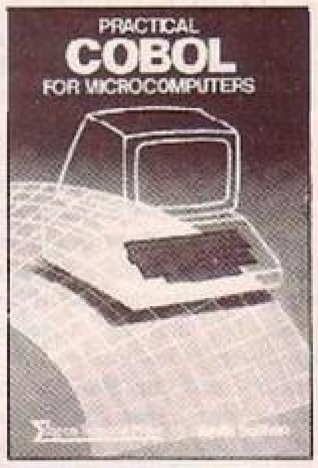
0 905104 43 9 226pp £7.95



Practical COBOL for Microcomputers
by Kevin Sullivan

BASIC is a fine language, but most business applications use COBOL, which is now widely available for all popular microcomputers. And, it's not a difficult language to learn: Kevin Sullivan takes you from writing the simplest possible COBOL program, through the use and design of screen layout, right up to handling all types of file.

0 905104 60 9 160pp £6.95

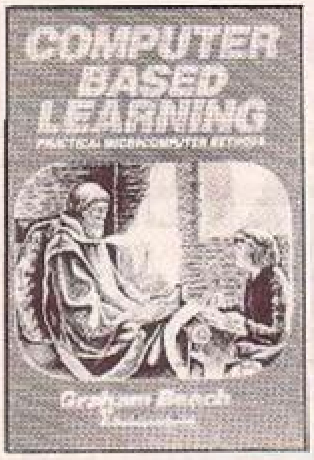




Operating Systems: A User Friendly Guide
by Alan Trevennor

A 'friendly' guide that uses the widely-used Digital Equipment Corporation's operating systems for its examples and spans the range of large minicomputers, all the way down to the new micros.
After describing the major components of all operating systems, the author describes how files are handled, error handling, hardware features and optimisation of hardware and operating systems.

0 905104 68 8 180pp £8.50



Computer Based Learning: Practical Microcomputer Methods
by Graham Beech

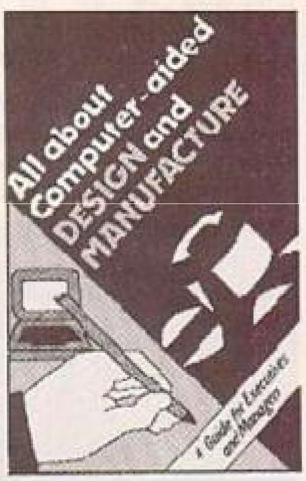
This is a definitive but practical book for all those wishing to educate, learn or train with the help of a microcomputer. To instil confidence, there is a comprehensive review of existing successful applications. These all use affordable microcomputers, and so can you!

0 905104 45 5 302pp £8.50

All About Computer-Aided Design and Manufacture
by James Fellows

Confused about CAD/CAM? Then, this is where to start. No more seminars, no piles of books and leaflets. Read this book and you will be able to understand all of the important concepts that are so necessary when **you** are responsible for installing computer aided design/manufacture equipment.

0 905104 61 7 200pp £9.95



The Universal Equation Solver
by Noel Kantaris and Patrick F. Howden

Equation solving is an art or science needed by many categories of people. This book proposes, in simple terms, a new easy to understand method which will solve equations encountered in any field of endeavour. The new method is presented with a series of program listings for Apple and BBC computers.

0 905104 40 4 120pp £6.50



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I could do that...

June's problem drew such a disappointing response that we decided to give you another chance. Do not be intimidated by the term Artificial Intelligence. We are simply looking for a program which allows you to have a conversation with the computer. What we have in mind is a dialogue along the lines of "who's there?" — "John" — "go away, John", but the wittier or more intelligent the computer's responses the better. The program should not be longer than 20 single statement lines. June entries will be held over.

We will award the £15 prize to the program whose questions and responses are judged to be the most amusing, or apparently intelligent.

BEGINNERS *first bytes*

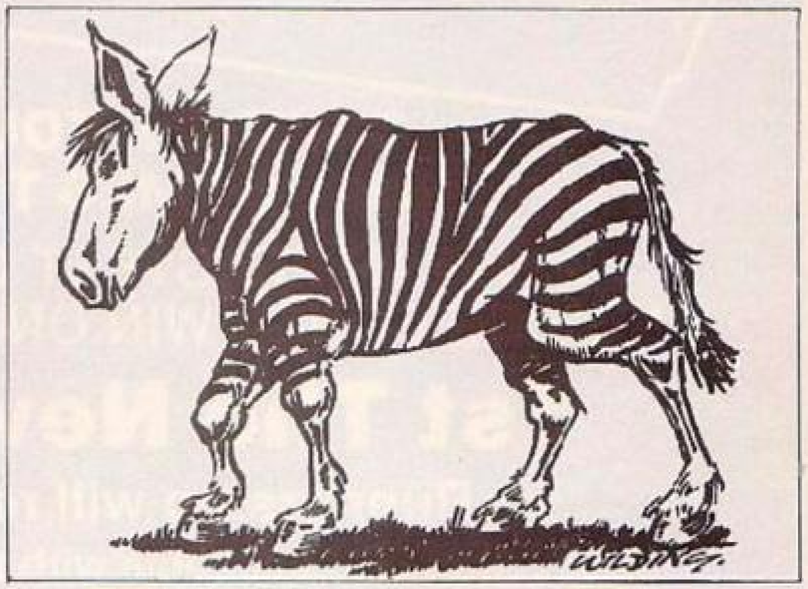
Starting out in home computing? First Bytes is for you. Just write to *Your Computer* with any hardware or software problems, no matter how small or simple.

Artificial Intelligence

THE IDEA THAT one day a computer brain may be more intelligent than you may seem unlikely as you struggle with the funny keys on your Spectrum. But when the first computers were built in the 1950s, many programmers believed that the dream of artificial intelligence or AI was not only realisable, but also just a matter of time.

It still is, but rather more time than they thought. Nowadays we are a little bit more realistic in what we expect from our bits of silicon.

(continued on page 39)



How to design and produce structured programs

YOU ARE THE PROUD new owner of a microcomputer. You've tried the "Welcome" tape, and perhaps typed in the programs in the manual and one or two listings from *Your Computer*. Now its your turn: you've got a great idea and off you go, charging through the program using all those neat tricks you saw in the manual.

However, if the program is any more than about 10 lines long, the chances are that it won't run first time. What a disaster, your program is doing all the wrong things and you can't understand why.

When you look back at your program you find its got more tangles than a plate of spaggetti. Frankly the chances of untangling it all are so slim that you might just as well pull the plug and start again.

So what is the answer? Right from the start you must develop a disciplined approach to your programs. Professioinal software writers use "structured programming" techniques.

They first express the problem they must solve in terms of functional blocks and then disect these blocks into individual procedures and decisions. Only after all this do they get down to the relatively easy task of turning this plan into code that the computer will actually execute.

Perhaps this is asking too much of the amateur, after all, all he wants to do is get a result out of his program as quickly as possible. He is not interested in winning points for neatness and style. However, if a little of this sort of discipline is used, you may find that your programs become easier to write, and above all, easier to put right when things go wrong.

Try to write some sort of flowchart for your program. This will allow you to see what the program is going to do next. Hopefully you will be able to work out how things should look as you go from one part of your program to another. Now you come to actually writing the code.

Since you will probably be using Basic, at least to start with, what should you look for in a well structured program? Well, there should be a series of subroutines, each corresponding to one of the boxes on your flowchart. This means that the pieces of your program are small, and so you should be able to list the whole routine on your screen at the same time.

The routine should perform a clearly defined function, and it should be possible to test it independently of the main program; you put test values in, of the sort you expect, and you make sure that when the subroutine has been run, the results are what you expected.

To take a simple example. Suppose your program needed to calculate the area of a circle. The subroutine to do this would look something like this:

```
999 REM CALCULATE AREA OF
    CIRCLE RADIUS R
1000 A=3.14159*R*R
1010 RETURN
```

Although rather trivial it demonstrates the principle. The subroutine performs one simple function and could easily be tested. You would simply type in:

```
R=3:GOSUB 1000:PRINT A
```

With a bit of luck, it should come back with 28.274 or thereabouts. Once that is done, you can forget about that module. A further refinement would be to check that the value of R was within a certain range. If it was not then a suitable error message could be printed or a flag set so that the main part of the program knew that a mistake had been made.

So what should a more sophisticated subroutine look like? Obviously, since you must use the Return statement to return to the part of the program the routine was called from, control must pass in an orderly fashion from the first statement to the last.

There should be no jumps from the subroutine, except to other subroutines, and there should be no loose ends when you have finished the routine. This means there should be no For-Next loops still uncompleted. In this way the subroutine can be easily pulled apart should anything go wrong.

Basic is perhaps not the best language for developing this disciplined approach to programs. It lets you get away with too much. The For-Next loop is often a source of trouble. For instance the following seems reasonable enough.

```
100 FOR I=1 TO 100
110 GET KP$
120 IF KP$<>"" THEN 350
130 NEXT I
```

This is a simple reaction test routine. It gives the player a certain length of time to press a key. If the player does then the program goes on to find out which key was pressed, if not the program continues with the routine.

However, you have just jumped out of the middle of the loop. Better to use a Repeat-Until structure. If your Basic does not have this command, then you will have to make do with the following fudge.

```
99 REM KEY PRESSED?
100 FOR I=1 TO 100
110 GET KP$
120 IF KP$<>"" THEN I=100:
    KP=1
130 NEXT I
140 IF KP=1 THEN GOSUB 1000:
    REM KEYPRESS ROUTINE
150 RETURN
```

In line 120, I is set to its limit value and a flag is set. As I has reached 100, the computer exits from the loop and, by looking at the value of KP, now tests to see if a key has been pressed. If it is 1, then the computer

(continued on page 39)

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Artificial Intelligence

(continued from page 37)

Instead of trying to copy some vague concept like "intelligence" which includes everything from perception, recognition, logic, intuition, and guesswork to commonsense, wisdom and perhaps even emotions, AI limits itself to very tiny specific areas.

These are often called expert systems because, like a human expert, they have detailed knowledge but only in a limited area. For example programs have been written that "know" as much as anybody about blood diseases, chemical analysis or oil prospecting, and which can be used by anyone who understands the technical terms.

Expert systems are becoming increasingly common in hospitals, laboratories and industry.

It is a strange fact that it is much easier to program a computer to be a world expert on obscure diseases than it is to get it to understand an English sentence. But it is precisely in these everyday activities that the secret of our intelligence seems to lie.

Recognising people and places, being able to pick out one conversation when several people are talking at once, or even just moving across a room without falling over or hitting something are things we take for granted but which, so far, have defeated the most sophisticated programs on the largest computers.

Part of the problem is finding the right way of programming. In Basic you tell the computer what to do at every point in the program: it is an imperative language. But to recognise some rare blood disease or a badly pronounced word we can hardly spell out to the computer how it should find the answer; if we could, then we would not need the computer. Instead, programming languages and techniques have to be developed that enable the computer to find its own way to the solution.

One of the first languages used in AI was Lisp, short for List Processing. This grew out of the idea that a lot of our knowledge is based on lists of things — words, facts, ideas. So, the language is built around the easy handling of lists.

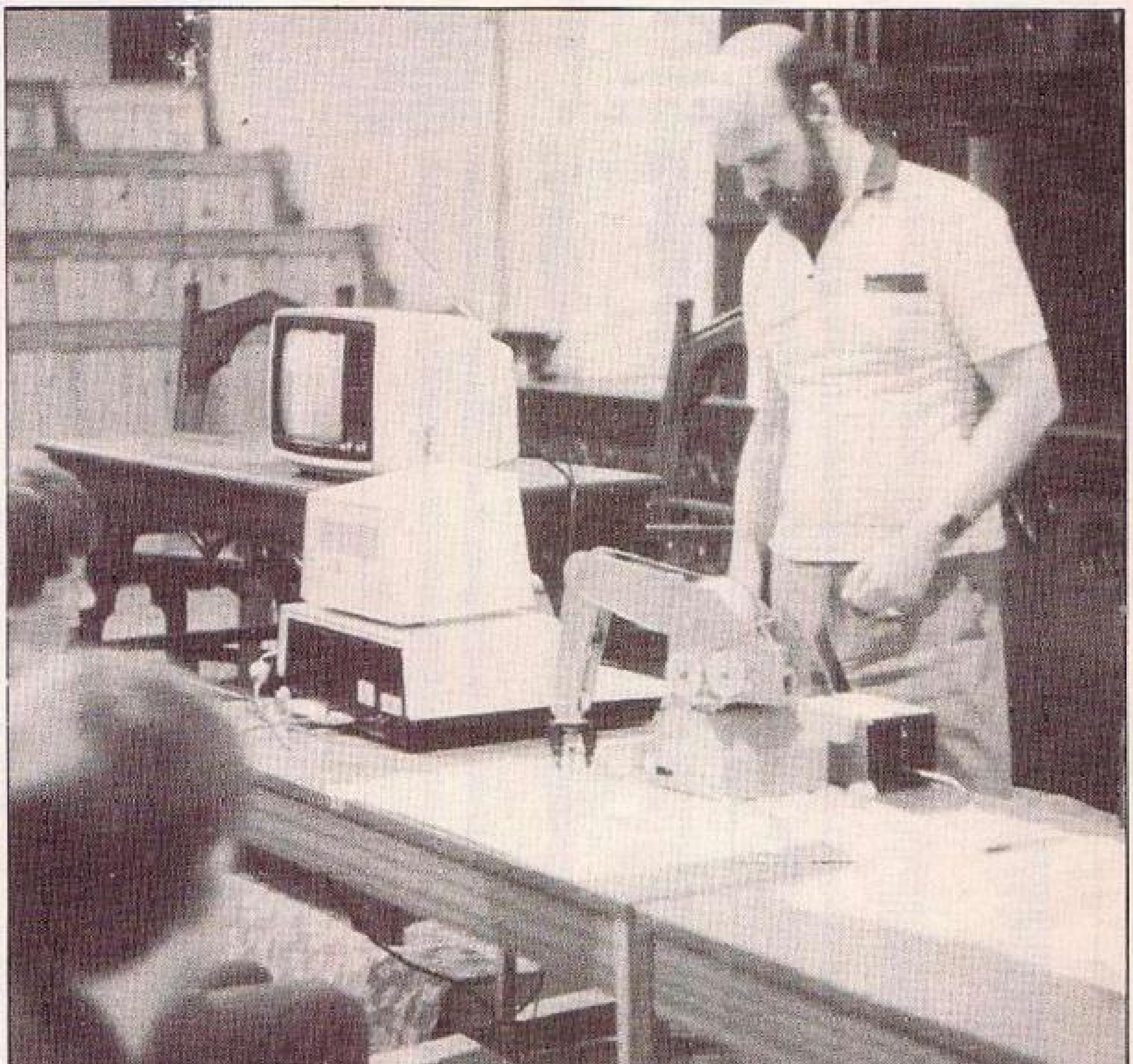
More recently, the language Prolog has been gaining in popularity. The name comes from Programming in Logic and moves a step closer to intelligence by building in the same ideas of logic that we use.

If you want to try your hand at turning your micro into some expert system, Lisp is available for a number of home machines including the BBC. Prolog is still limited to the more expensive professional micros, but will doubtless filter down eventually. Another language that is becoming increasingly popular in the AI field is Logo, better known for its turtle graphics.

For the real enthusiast who wishes to make AI do something there is always the micromouse competition which combines AI and robotics. An independent microcomputer-controlled device has to find its way to the centre of a maze in the shortest time. It is allowed several tries and can therefore gradually learn the plan and use its intelligence to work out the quickest route. This is all good fun but clearly AI has rather a long way to go before we produce the all-singing, all-dancing intelligent android.

BEGINNERS

first bytes



How to produce structured programs

(continued from page 37)

goes to the keypass subroutine. Of course KP would have to be set to zero before this routine was used again.

So much for the subroutines, what about the main program. This should start at the beginning, go to the end, and there stop. Control should flow from the first line to the End statement calling subroutines as it goes. Avoid Goto like the plague, especially the computed Goto.

You may think this is a recipe for a very dull program; if you can not change the direction of the flow of the program how will it do anything different? That is simple, your main routine will call subroutines according to what happens, just like the keypress example given above.

The beauty of subroutines is that as long as they have been written correctly, they always pass control back to the point they were called from, preserving the linear flow of the program.

Ideally all these subroutines should be placed after the main program, fenced off from it by an End statement. However, as I am sure you are aware, Basic interpreters look for lines from the top down. So if you require speed, your most often called subroutines will have to be at the beginning of your program. This means that the very first line of your program will have to be a Goto statement which will skip the subroutines and start executing the main program. Hardly pretty, but effective.

There is so much more that can be said about good programming technique; this article has concentrated on just one aspect: making sure you know where your program is going. Tracing the path taken through your program when it is being executed is vitally important, a task made a lot easier if you have some sort of trace command in your Basic vocabulary.

It cannot be emphasised enough that if you jump around all over the place and leave loose ends hanging around, sooner or later you are going to be tripped up. Perhaps you will get away with it to start with, but as your programs become more involved the problem will get worse. You may also have a tough time if you want to add a bit to your program at a later date to enhance it. You will have forgotten exactly how you wrote it.

Should you start to use machine-code, exactly the same principles apply, only more so. Losing control of a machine-code routine will usually result on the machine hanging up as the processor blindly blunders on through your code.

If you have anything of interest to tell us about your computer club why not contact us on 01-661 3144.

Local news

Harrow

LUG is the acronym for Lynx Users Group. It takes over from NILUG, as Mr R Poate is closing down operations. Are you a Lynx user feeling out in the cold? Contact Mr R B Jones, 209 Kenton, Harrow, Middlesex. Telephone: 01-907 3406.

Burnley

The International Sinclair User Group was formed in August 1983, following the closure of Tim Hartell's National ZX User Group. ISUG now boasts members in Eire, Germany, Spain, Malaysia and Saudi Arabia. Membership brings a monthly newsletter and 20 per cent discounts on a wide range of software. Contact ISUG, 189 Rosehill Road, Burnley, Lancashire.

Truro

The Truro and St Austell Colour Genie User Group keep the flame burning in the Tandy Shop, St Austell, Cornwall on the first Friday of every month except May and July. 50p per meeting to cover expenses. For more details, contact Janine Allen, Flogholeth, Point Road, Carnon Downs, Truro, Cornwall.

Shrewsbury

The 32K Vic-20 Users Club shies away from gross commercialisation, but has been set up to give more to this minority group of users. Anyone who wishes to join can submit and request programs, just paying the postage required. There will also be a regular newsletter. Contact M Valentine, 101A Underdale Road, Monkmoor, Shrewsbury, Shropshire SY2 5EF.

COMPUTER club

If Shakespeare had been born 400 years later, would he have been a printed circuit bard? Paul Bond goes in search of micros in the great man's birthplace.



IF ALL THE YEAR were playing holidays, to sport would be as tedious to work. Thus the great bard of Avon on moderation in recreation; nevertheless, since it is that time of the year when most computer clubs experience a slight drop in attendance, due to the "playing holidays", it was understandable that the Stratford-upon-Avon computer club should have less than a full house when *Your Computer* paid its visit.

John Williams, editor of the club newsletter, was in control of things on the evening of our visit, as club secretary Chris Parry was occupied with technical rehearsals at the local Shakespeare Theatre, where he is in charge of stage lighting.

The club was formed in May 1983 to promote greater interest in personal computing and to help its members use, learn about and understand personal computers in general.

There were 98 members at the last count, encompassing machines ranging from Nascom IIIs to TI-99/4As to ones which have enjoyed greater commercial success on the open market.

John Williams has about 33 RML 480Zs in his care at the South Warwickshire College of Further Education, where he is a computer technician. Nevertheless he has managed to avoid being roped in to the teaching evenints which the club runs apart from its regular meeting on the second Wednesday of every month at the Wesley Hall, opposite Trinity Church, Stratford-on-Avon.

A Methodist minister from Wellsbourne, the Reverend Farthing, has been giving a series of exhaustive lectures on Z-80 machine code, and other members teach Basic at various levels.

John Williams had given a talk about Pascal: "Most people have seen a bit of Basic, but very few get opportunities to glimpse any other language."

Stratford-on-Avon is becoming a bit of a haven for would-be computer users, it would seem. There are summer schools at the aforementioned South Warwickshire College of Further Education, attended by people from all over Great Britain, who want to revel in the local scenery and cultural heritage at the same time.

Sisters Caroline and Julia Tate had the advantage of a BBC Micro at home and had to admit that they were keen games players, though they didn't subscribe to any of the popular myths about girls particularly liking Pac-Man. Neither did Caroline's computer class at school find it necessary to segregate boys and girls in order to make sure that girls get a fair chance.

Adam Tate, who denied any familial connections with the previous two was the proud owner of a TI-99/4A. He was more than happy with the implementations of Space Invaders and Wumpus on this machine, and spoke of rumours of the machine's coming back into production in much the way NewBrain owners are known to do.



An exalted use for the humble BBC, not immediately thought of as a laboratory tool, was revealed by Barry Lancashire from the National Vegetable Research Station, at Wellsbourne. Nevertheless, this is the micro recommended by the Agricultural Food Research Council (AFRC). The NVRS uses it for image analysis of crops photographed from the air by a radio controlled video camera suspended by gimbals from aeroplanes, kites, balloons, balloons-cum-kites. "We've tried everything except Microlites," said Mr Lancashire.

The BBC is also used for transient waveform analysis of information from pressure transducers.

As far as image analysis goes, Mr Lancashire said. "It's not the image, but the way of getting it. Colour and tone can be confused: pale green foliage might be confused with pale dry soil, for example. Infra-red photography seems most successful." Despite its cost-cutting exercises the NVRS, whose work is valuable to third world countries, finds itself facing the axe from a government more concerned with defending people than with feeding them.

The club itself also looks forward to a more hi-tech approach: facilities for control projects are to be provided by a local company, SI-Plan Electronics. Club info from Chris Parry on Stratford-on-Avon 68080.

SOFTWARE Shortlist

Star★ chart

Alcatraz Harry

48K Spectrum:
Graphic adventure:
£1.99:
Mastertonic:
★ ★ ★

Alcatraz Harry is bent on escape, and so travels around Alcatraz picking up escape gear. Once this has been accomplished you thread your way through a mine-field to a hole in the outer fence. Nothing very taxing, not bad for the money.

Psycho Shopper

8/16K Vic-20:
Arcade:
£1.99:
Mastertonic:
★ ★ ★

Breathes new life into the Frogger concept. It provides not just one but four different busy thoroughfares to cross with the added complication that you must pick up objects on the way. The game climaxes in a supermarket where you have to dash across the floor and raid the shelves.

Maze Gold

Unexpanded Vic-20:
Maze game:
£5.95:
Visions
★ ★ ★

A ponderous variation on the maze theme. You jump from character space to character space collecting gold bags and dodging nasties. If your interest holds out you can then exit to another screen for more of the same.

Horace Goes Skiing

Dragon 32:
Novelty:
£5.95:
Melbourne House
★ ★ ★

A two-stage game in which you must first guide Horace across a road and back before you get a crack at the slalom course. Not surprisingly the road is packed with speeding cars and juggernauts.

Tales of the Arabian Nights

■ *CBM-64*
■ *£7.00*
■ *Interceptor Micros*
★ ★ ★

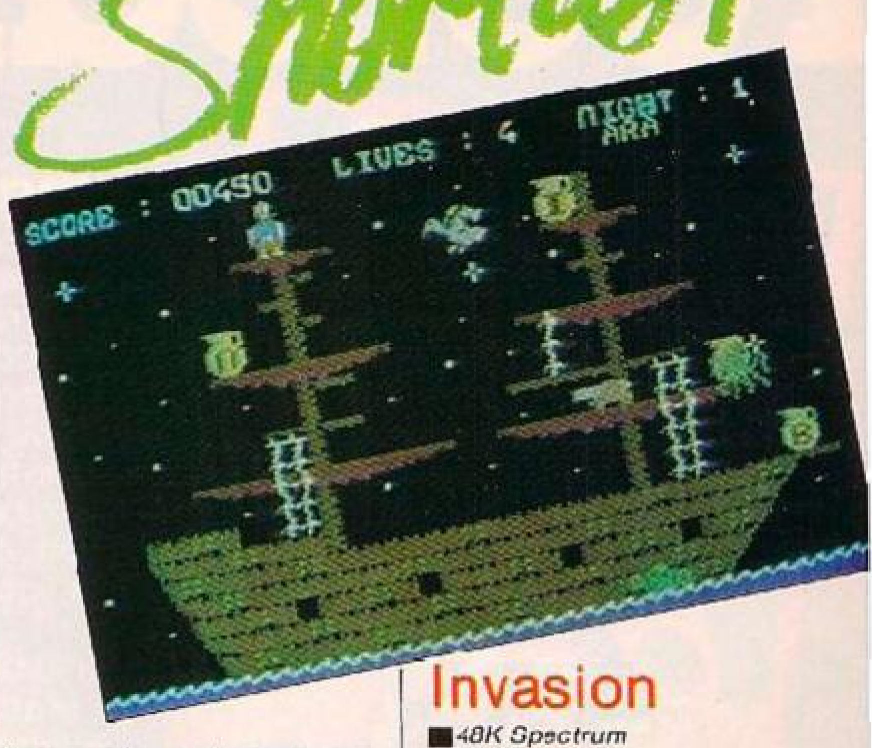
AT THE START of Arabian Nights a voice through the TV speaker sets the scene for the opening screen: "Imrahil began his quest on Sinbad's ship, sailing the perilous waters of the Red Sea." In all there are eight different screens and each is introduced by a few lines of computer-generated speech. Sounding rather like someone speaking under water, the voice is notably indistinct but it adds considerably to the enjoyment of this Manic Miner style game.

In the first screen you have to work your way round a galleon, collecting golden jugs by climbing the masts and jumping from platform to platform. At the same time there are hazards to be avoided in the form of octopuses, cannonballs, and a large flying bird — possibly a roc. Following this you find yourself on a raft floating down a crocodile-infested river.

Later screens include a fortress, a desert landscape, and an Arabian city. Since the game draws inspiration from the Arabian Nights, naturally there are also palm trees, flying carpets and turbanned genies.

The interest in this sort of game lies in working out the correct route, in finding the right sequence of objects to be collected and jumps to be taken. In this respect Tales of the Arabian Nights is fairly demanding although it does not require the degree of accuracy and tortuous attention to detail that make Manic Miner so engrossing.

Nor are the graphics as finely drawn or as wittily original as they are in Manic Miner. Nonetheless — comparisons aside — the game has a high entertainment value.



Invasion

■ *48K Spectrum*
■ *£6.99*
■ *Argus Press Software*
★ ★ ★

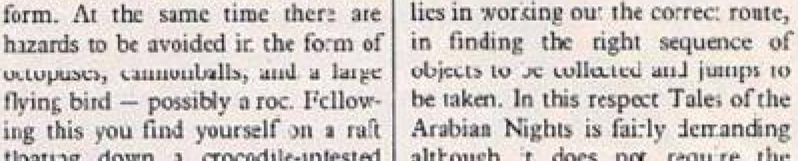
IF YOU ARE fed up with zapping aliens in real time with amazing graphics, sound the works, then here's something that might be more up your street. The Reds are coming and it's up to you to defend your homeland.

The invading hordes enter from the top of your 8-by-12 grid which represents the homeland. You have eight armies under your command with which to attempt to repel the foreign hordes. Scattered over the map are 14 cities which you must defend, lose the lot and it's the firing squad for you. The unkindest cut of all is also meted out if you allow any of the invaders to march off the bottom of the map — presumably because they then threaten something vital, like the Presidential Country Retreat.

Each turn you are given 10 resource points per town under your control. These can be used to build new units or allow ones you already have to attack. Attacking seems to be a good idea in this game, so these supplies are vital. You can then give each army one command, either change its strength or move it. The effectiveness of an army is affected by its morale: if it gets badly mauled, its morale sinks; an easy victory and its morale and effectiveness rise.

All this leads to some tricky decisions for would-be Pattons. Trying to defend every inch tends to be an expensive and morale-sapping exercise.

However, the choices and strategies open to you seem somewhat limited and once the right mix of the two mentioned above has been discovered, I doubt if the game has that much more to offer.



Evil Dead

■ *CBM-64*
■ *£6.99*
■ *Palace Software*
★ ★ ★

A WHILE BACK THERE was a flurry of concern at the possibility that video nasties would spawn a generation of equally unpleasant computer games — computer nasties.

At the time you might have wondered if home computer graphics were capable of the sort of gory special effects video nasties trade in. The Evil Dead would confirm your doubts. It is a spin-off from the horror film of the same name but there is nothing here to keep even the most unworldly 12-year-old awake at night.

The computer version is said to follow the plot of the film. Ashley, a naive teenager, together with four chums is trapped in an isolated house inhabited by the spirits of the undead.

Translated to the computer screen the game turns out to be a distant

(continued on page 45)

SOFTWARE Shortlist

Star★chart

Gravitar

Oric-1/Atmos 48K:
Eat-em-up:
£7.50:
Severn Software
★ ★ ★

With four controls: rotate left, right, thrust and tractor beam, you have to guide your intrepid spaceship around the screen picking up fuel pods, avoiding the gunfire from enemy emplacements, and avoiding a low flying spaceship. If this wasn't bad enough, you've got momentum and gravity to cope with. The game calls for patience and very delicate control.

Crusoe

48K Spectrum:
Adventure:
£6.00:
Automata
★ ★ ★

In this graphics adventure you take the part of the well-known castaway trudging round a desert island with 75 items to track down. The program is nicely presented with several screens for you to explore. William Bones has left plenty of clues strewn around the place for you to solve. The text appears in Tresure Island script, with suitably rustic messages.

Classic Racing

Oric-1/Atmos 48K:
Boardgame:
£7.95:
Salamander
★ ★ ★

For one to six players, each player has a stable of 16 horses of unknown form. Your job is to attempt to find out which horses are most suitable for what sort of going — and which are most suited to the glue factory — in time for the big meetings at the end of the season. With less than six players, the computer plays the other stables. A whole season of 16 meetings can provide a long and absorbing game. Fortunately you can load and save games at any point.

relation of Atic Atac, in which you have to move from room to room fighting off hostile beasties. The difference between this and Atic Atac is that there is no ultimate goal: your object is simply to stay alive for as long as possible.

To cope with the monsters in your path you have a supply of destructive energy which can be replenished by picking up a weapon. Alternatively, you can attempt to shut them out by closing windows and doors.

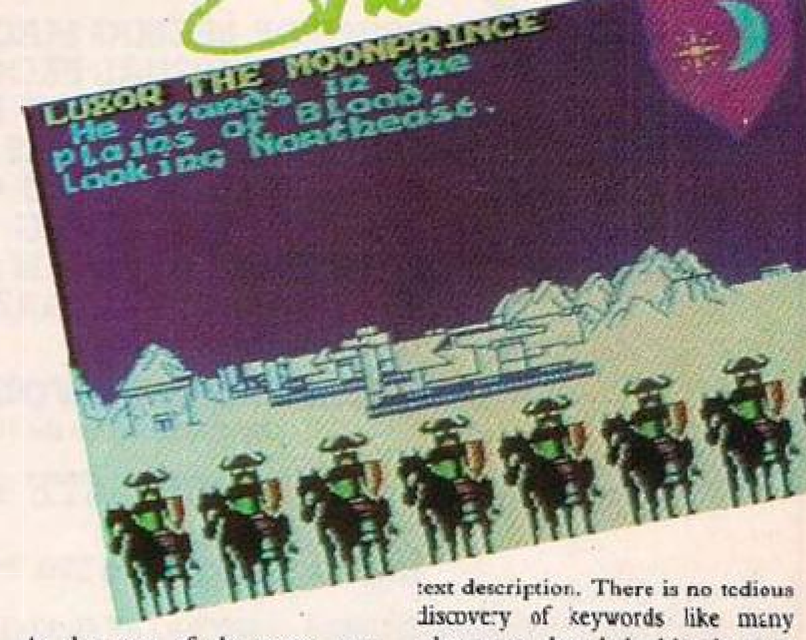
Once attacked the mosnters split into parts which in turn enter the fray. As your four friends are also likely to mutate into monsters you find the house soon fills up with a variety of Evil Spirits, zombies, pink things and dismembered limbs. Clearing the screen becomes uphill work.

The Evil Dead sports some excellent graphics particularly in the way the characters are animated. A computer nasty it is not: anyone who fears, or hopes, that it might be a real sickener will be disappointed. But there is enough variety in it to keep the interest alive for a good few playing hours.

Lords of Midnight

■*48K Spectrum*
■*£9.95*
■*Beyond*
★ ★ ★

THE LORDS OF MIDNIGHT is a graphics adventure based loosely on Tolkien's *Lord of the Rings*. Saying this is rather like saying a Porche 924 is a motor car based on the Model T Ford. This program is simply in a different league from graphic adventures that have gone before.

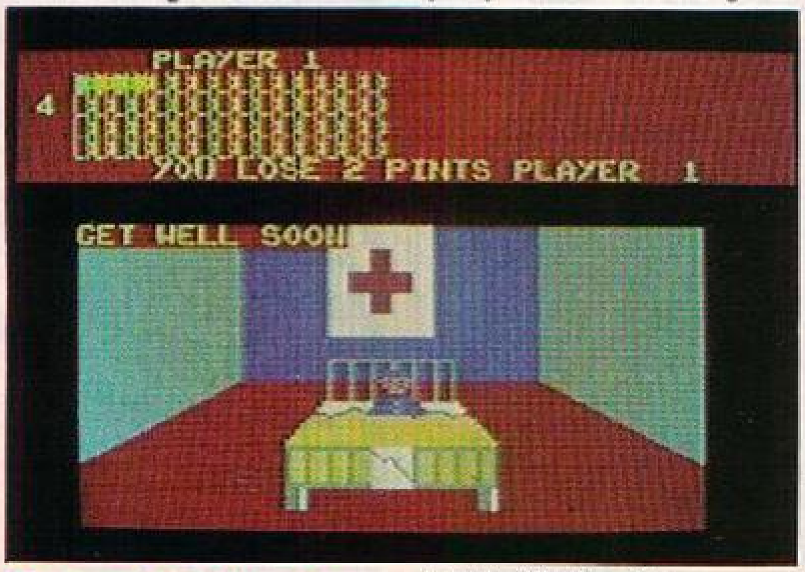


At the start of the game, you, Luxor, the Moon Prince, are standing with your three chums surveying the Land of Midnight; the forces of Doomdark the Witchking are preparing to give the land of the free — the good guys — a hard time. If you've read *Lord of The Rings*, the rest of the plot will be fairly familiar to you. There are two ways that you can defeat Doomdark: capture his ring of power, or defeat him in battle; neither is a picnic.

Beyond claim to have crammed 30,000 locations into the game. The effect is truely breathtaking. While at any of these locations you can look in eight directions and the computer quickly draws the view and gives a text description. There is no tedious discovery of keywords like many adventures, the whole thing is menu driven, different options being available depending on location.

The game proceeds by you giving instructions in turn to the various characters under your command. As you are moving them, you can find objects, recruit men and other leaders, which you can then in turn move, and of course you can do battle with the forces of midnight.

Once you have completed a character's actions for the day, you go on to another. When all your characters have been moved, you press the Night button, and the computer sets to work moving the forces of darkness around and working out the outcome of battle.



Bozo's Night Out

■*CBM-64*
■*£6.90*
■*Taskset*
★ ★ ★

BOZO'S NIGHT OUT puts you in charge of Bozo, an inveterate drinker. It is your responsibility to guide him home after a hard night in the pub. Getting him safely home racks up a score of five pints, whereupon you can pick him up at the pub door the following night.

Bozo has a choice of two routes, along the street or a shortcut through the park. On the pavement he is threatened by policemen, muggers and ladies of the night, while the park contains as assortment of unpleasant creatures and malevolant plants. Using the joystick you need to steer Bozo.

This scenario is illustrated by some amusing cartoon-style graphics.

It might have been more realistic and exciting if Bozo were given a chance to defend himself.

Gems of Stratus

■*Amstrad CPC-464*
■*£7.95*
■*Kuma*
★ ★ ★

GEMS OF STRATUS is one of the first independent software releases for the new Amstrad computer. The game is an adventure with graphics which uses the Amstrad screen windows to good effect: you put your commands into one window and the machine's replies come back on two others and the view of your present location is in a fourth.

Movement is by use of cursor keys and full use is made of the keyboard buffer which, once you have made a map, allows you to move very rapidly around the maze of rooms: you simply hit the appropriate cursor keys the required number of times, and sooner or later the machine catches up with you.

Your object is to find the hidden trove room and "the hidden wealth of AM". Well we have to admit we never found them.

The game is rather frustrating, but if the clues were too easy the game would soon lose its value.

NEWS

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The crystal ball

The Adventurer's Notebook is a new volume from Duckworths. Priced at £3.95, it includes ready made maps and notepads for use when playing, a history of adventures, a personal list of the best, and a useful set of syncnyms and suggestions for when you're stuck.

Salamander Scftware are bringing our their Dan Diamond trilogy in a single package for the Spectrum. The trio consists of Dan Diamond, Lost in Space and Fishy Business

If you've a disc drive, look out for Infocom's Sorcerer — the second in the Enchanter series — and Seastalker — the latest Tale of Adventure. Retailing at around £40 each, they're worth going into the red for.

Commocore have secured the publishing rights to the magnificent Zork trilogy, Infocom's earlier masterpieces. Disc only but well within your pocket at the new low price of £11.95 each.

A helping hand

Hobbit players now have the excellent Melbourne House "Guide to Playing The Hobbit" (£3.95) so no help from me as well — fair's fair!

For fans of Micrograf's BBC Adventure, Flint's Gold:— At the platform but can't cross the lake?
LLEB GNIR:TAOG PORD

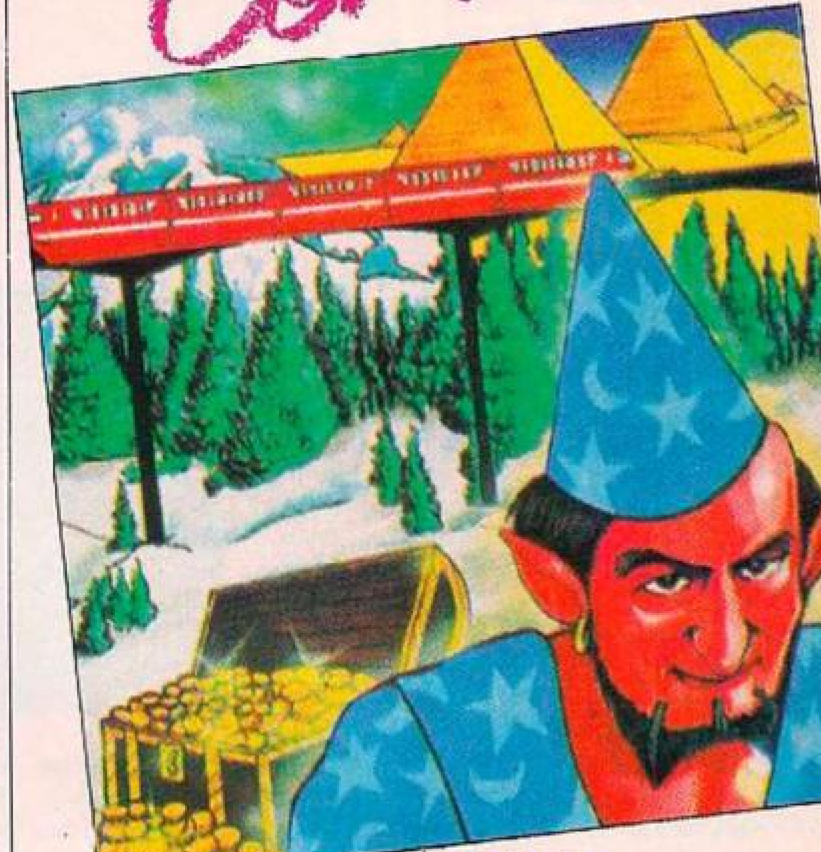
In the Gloomy Room but can't locate a hidden treasure map?
KOOL:GELGEP
TEG:KOOL:LOTSIP ERIF

For Phipps' Colditz Prisoners:— Hacksaw breaks trying to open grate?
(REVIRDWERCS HTIW)
ETARG WERCSNU

Yours in flame and frustration.
HUGO NORTH

QUEST Corner

Our man with the brass lamp and the key to a thousand mysteries sheds light on new adventure programs. Lost? Never fear, Hugo North is here.



Wizard's Challenge

- BBC B
- £7.95
- Program Power

WITH A TITLE like that and a mission to recover 12 treasures for an evil wizard, you might think you'd be plunged straight into a mystic wood or into an eerie underground labyrinth. In fact you start off on some school playing fields. Exploring this rather unusual jumping off point, you'll find, among other places, a tuck shop, changing rooms and dining hall. What on earth can you do with a school dinner (except perhaps to use it as a weapon, if mine were anything to go by).

Further searching may result in you getting wounded — it may be only a cut finger but it could finish you off before you've barely begun your quest.

A lamp is soon located which can only mean one thing — you'll shortly be going to places deep, dark and dangerous. However, when you do go down, things are not at first what you might expect. A Brutish Rail (yes, Brutush) underground station is the first of several surprises.

There are over 100 locations and some 50 problems to solve in this enjoyable text adventure. Response to input is immediate and although there are one or two spelling errors, it doesn't mar what is an entertaining program.

Paradox

- Spectrum 48K
- £7.50
- Runescft

THERE HAS BEEN a surge in the number of Spectrum adventures, due mainly to the availability of Gilsoft's "The Quill" adventure generator. Paradox is such a Quill produced program, and a pretty interesting one it is too.



The environment you are invited to roam is divided up into four main areas: the Tunnel — where you start — the Gamesboard, the Crystal Palace, and the Magicians' Rooms. One feature of this adventure is that it only tells you of exits other than the one that leads back to where you have just come from — and even then, you can't always guarantee that you'll be able to return the way you came.

The Tunnel is what you would anticipate — various interconnected chambers where you'll find useful objects or sudden death. You can't afford to fiddle around too long — a raging thirst drives you to find water.

The Gamesboard will provide clues and riddles — unless you solve them, you won't gain access to the Crystal Palace.

With 150 different locations and puzzles and paradoxes a'plenty, this text adventure may well keep you occupied until Christmas.

Castle Blackstar

- Spectrum 48K
- £8.95
- SCR Adventures

FOR THOSE WHO like their text adventures meaty, Castle Blackstar should prove toothsome fare. It is a complex, puzzle-rich quest that challenges you to score a maximum of 240 points which are gained by finding and returning treasures, performing certain actions and accomplishing the main objective of your mission — to find and return the lost orb to the Lady Artemis.

You start your journey in the vale of Castle Blackstar. Wander too far from the path and you'll be lost in a forest maze. Experienced adventurers will be well aware that the best way to map out a maze is to drop objects along the way so make sure you find some before going on a forest jaunt.

There are plenty of intriguing and unusual objects and puzzles, many of which will undoubtedly have you reaching for the aspirins. As a small taste of what's in store, difficulties along your way include an invisible hand, eagle eggs and a water-logged boat.

Original and challenging puzzles, fast response, a comprehensive vocabulary and plenty of atmosphere make Castle Blackstar a worthy contender for your hard won gold.

TOSHIBA HX-10

Graham Bland looks at what the vanguard of the MSX invasion has to offer



IN A BID TO REPEAT their success in Japan, a number of manufacturers recently announced their intention to launch MSX systems in the U.K. Toshiba has emerged as the pace setter in the race to customise a micro for the more sophisticated British market. The HX-10 Home Computer seems likely to beat Sanyo's Wavy 10 and Sony's Hit-Bit to a place on the MSX shelves this month, albeit by a narrow margin.

Toshiba's machine is unexciting when compared with other systems from the land of the rising sun. The HX-10 does not have any of the goodies promised with some other MSX micros such as video interfacing, robot arms, and music synthesisers. But what it will have is a more competitive price tag.

Cosmetically, the HX-10 appears functional rather than glamorous — a slab-like dark-brown box, not exactly ugly, but it is hardly inspiring either. The overall construction is very workmanlike, a solid heavy micro that looks as if it could take a good bashing and has the endearing habit of staying put while you are typing.

Interfacing made easy

Communication with the outside world is relatively simple. At the back of the machine are phono socket connections for output to TV set or monitor, and a DIN socket to hook up a cassette recorder. Also hidden round the back is the bus connector which is ominously marked "For Only Toshiba Use". This expansion bus connector will come into use when disc interfaces become available, as well as RS-232 drivers and the like. On the side of the machine are two D-type joystick sockets and a Centronics printer socket.

The all-important cartridge slot is accessed from above. How often this slot is used will depend on how many U.K. software houses opt for cartridge media in favour of cheaper and more popular cassettes.

As keyboards go, the HX-10's is a long way ahead of those found on the Sord M-5 and the Spectrum, but not quite in the league of the BBC model B or Electron. As such, it represents a reasonable compromise between low-cost and usability. Of the 73 keys, five are programmable function keys — or soft keys as they are sometimes known.

A rich set of foreign characters are available from the keyboard using the Code key, including French, Spanish and Greek, as well as graphics characters which are produced using the bright-green Graph key. The minor points which annoyed me while using the HX-10's keyboard were the tiny backspace key, the cramped cursor keys and the absurd colour scheme adopted, green, blue, brown and white.

In Japan, Toshiba was one of the few companies to offer a 64K machine. Seemingly, Tokyo's man-on-the-street is quite happy with a measly 16K computer. Of the two systems that Toshiba had available in Japan, they wisely adopted the 64K version instead of the 32K model.

If the promise of 64K seems mouth-watering, prepare for a sudden loss of appetite when you switch on the HX-10. After the copyright message you are informed that there is only about 28K available to MSX-Basic programs. Graphics support immediately claims 16K and the rest of the missing memory is squirrelled away for some undisclosed purpose — perhaps lying dormant awaiting the arrival of a disc-operating system.

Displayed at the bottom of the screen are the values of the first five function keys. The second five values may be displayed simply by holding down the Shift key. To remove this display, the command Key Off will do the trick. You can assign your own character strings to any of the function keys. For example:

KEY 1,"? FRE(0)" + CHR (13)

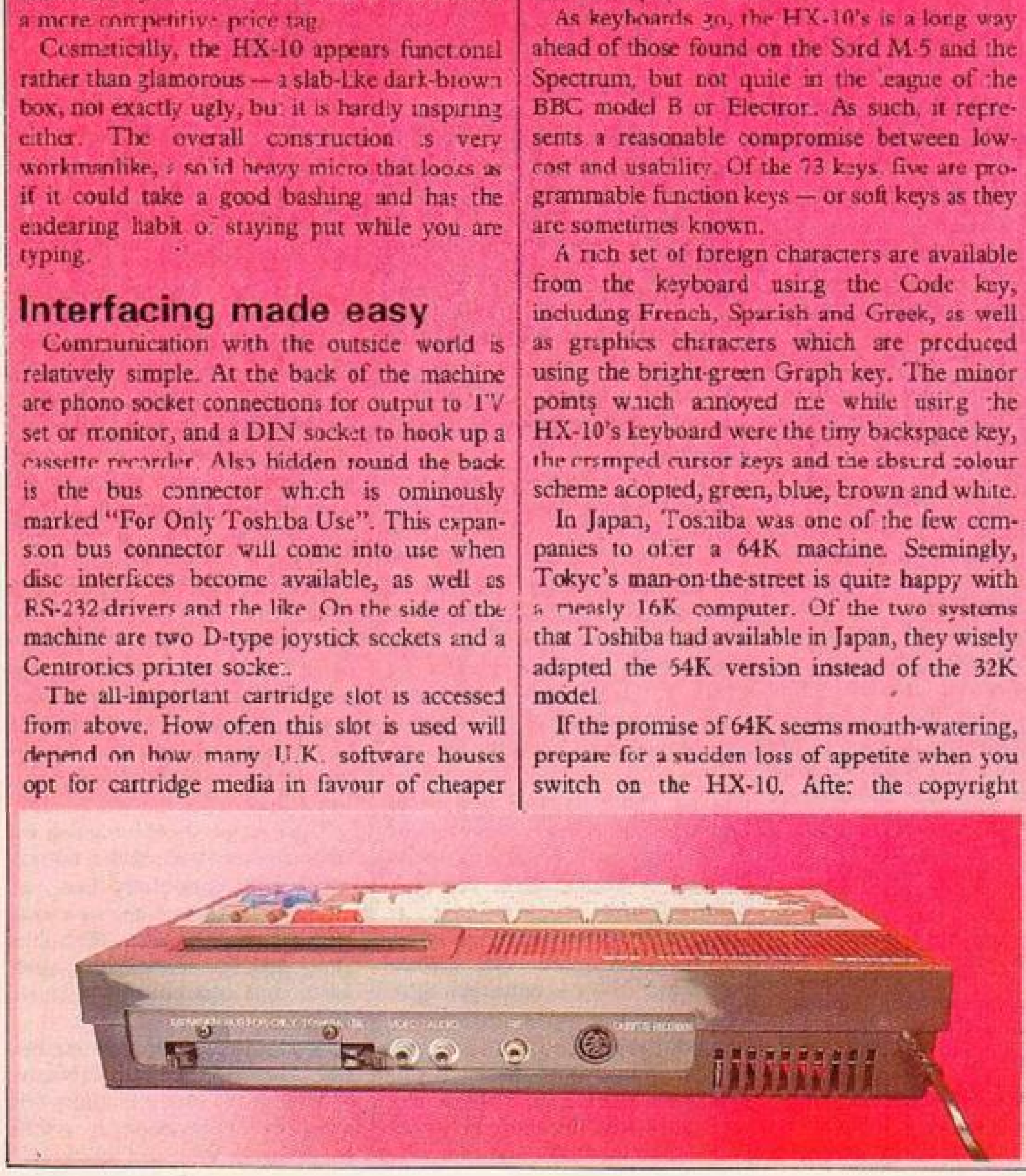
will print out the amount of free memory every time function key number 1 is pressed.

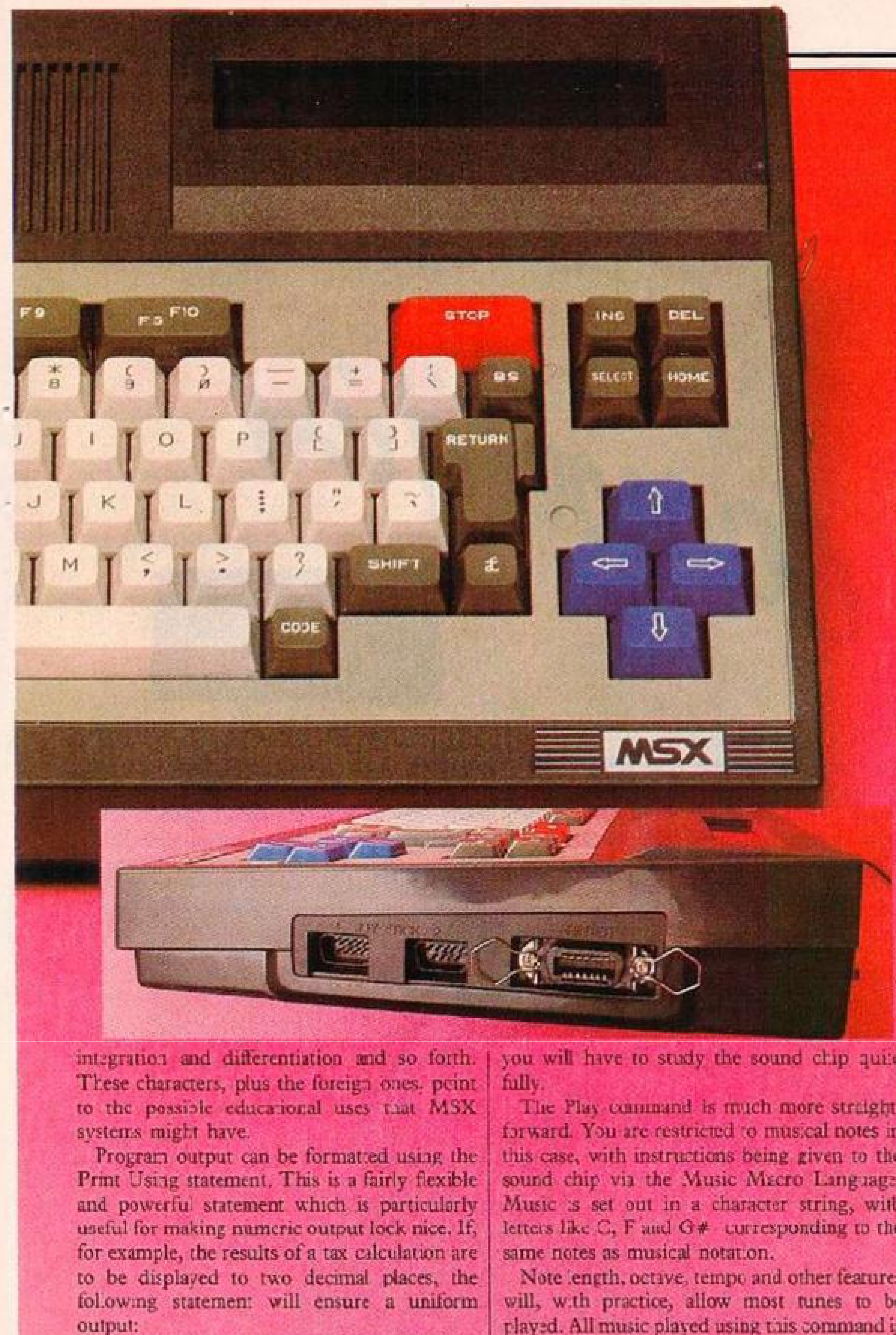
MSX-Basic is very nearly an 8-bit IBM PC Basic, offering a nice spread of arithmetic functions, good graphics and sound and a few other elegant touches which must make it one of the best home micro Basics around.

All arithmetic is calculated to double precision — up to 14 decimal places — which does tend to slow programs down a bit, but this trade off is acceptable if accuracy is the most important consideration. Data types can be declared as binary, hexadecimal and octal as well as the standard characters, integers etc.

Entering programs displays both a weakness and strength in the Basic. Unfortunately, the interpreter does not check lines as they are entered. To compensate, there is an excellent full-screen editor. It is a shame that the designers could not combine both these features in the way Atari has on the 800XL.

As mentioned earlier, the HX-10's character set is fairly complete. There is a full range of scientific symbols, a music note, signs for





integration and differentiation and so forth. These characters, plus the foreign ones, point to the possible educational uses that MSX systems might have.

Program output can be formatted using the Print Using statement. This is a fairly flexible and powerful statement which is particularly useful for making numeric output look nice. If, for example, the results of a tax calculation are to be displayed to two decimal places, the following statement will ensure a uniform output:

```
10 PRINT USING "# # # . # #",TAX
```

Other options allow field fillers, + or − signs, and the insertion of a string variable into a constant string.

Powerful sound chip

The sound available from MSX Basic is also quite impressive. At the heart of every MSX micro lies a dedicated sound chip — General Instruments AY-3-8910 — the same chip used by the Oric Atmos and Memotech MTX series, in fact. It is capable of producing three notes simultaneously over a range of eight octaves with an optional noise channel to produce helicopter and explosion noises. To kick this chip into life, you can use one of two Basic commands: Sound or Play.

Sound is the most flexible of the two but much harder to use. It is little more than a specialised Poke instruction; values are sent to one of the sound chips' 13 registers accessible from the Basic. Not having a manual available you will have to study the sound chip quite fully.

The Play command is much more straightforward. You are restricted to musical notes in this case, with instructions being given to the sound chip via the Music Macro Language. Music is set out in a character string, with letters like C, F and G# corresponding to the same notes as musical notation.

Note length, octave, tempo and other features will, with practice, allow most tunes to be played. All music played using this command is placed in a music queue for summary execution. So once told what it is to play, the HX-10 can continue to perform some other task.

With 16K of your precious memory dedicated to graphics support, you get the feeling that the graphics capabilities of this machine ought to be quite good. Though not in possession of an ultra-high resolution screen like the Beeb's, the HX-10 can squeeze quite a lot from its fairly moderate 256 by 192 resolution screen. The nicest thing about MSX Basic's graphics statements is that they are very easy to use, and due to the allocated video RAM, reasonably quick too.

with the HX-10, I can only hope that this feature is well documented. There are no equivalents of the Oric's Zap and other sound commands. If you want these from MSX Basic

There are commands to draw circles, lines and boxes, a Paint command, and 16 colours available. Best of all, you can declare up to 32 sprites. Fortunately, there are no Poke instructions required to set up a sprite thanks to the provision of a special variable called Sprite$. Sprites are placed on the screen using the Put Sprite command. A number of these graphics statements such as PSet, Circle, and Put Sprite have the option to specify absolute or relative co-ordinates.

By putting the word Step in front of a set of co-ordinates, the shape or point is placed relative to the last point addressed on the graphics screen. This speeds up the movement of sprites etc. across the screen as there is no need to waste time calculating the object's next position.

Text and graphics

There is, however, no easy way to put text into a graphics screen. What you have to do is: open the graphics screen as a named file (GRP:) and use a Print# statement to send a character string to the screen. This is hardly convenient particularly as the character string will be placed at the last point addressed on the screen.

Possibly the best feature of this Basic is its interrupt statements. Rather than polling for an event such as the spacebar being pressed, you can set an interrupt which will cause a branch to a subroutine when the event occurs. The following short program will print out the product of 100 by 100 repeatedly until the spacebar is pressed, when it will print out "HELLO":

```
10 strig(0) on
20 on strig gosub 40
30 print 100 * 100 : goto 30
40 print "HELLO" : return
```

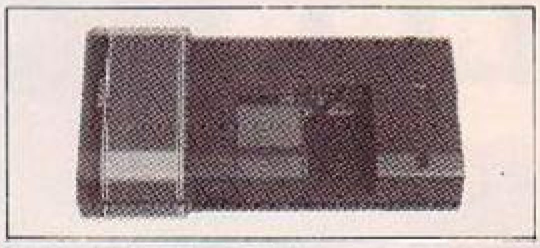
Interrupts may be set up to monitor the function keys, sprite collision, time intervals, and trap events such as errors and the production of a Ctrl-Stop signal. This feature of the language makes up for the omission of a While-Wend statement. ■

CONCLUSIONS

- Overall, the Toshiba HX-10 is a pleasurable system to use. It does have its drawbacks but these are generally too few to worry about. It is much better than the ill-fated Spectravideo — almost an MSX computer but not quite — being curiously faster with the obvious advantage of a full-pitch keyboard.
- It will be a long time before the full impact of MSX is realised in the U.K. The standard promises cheaper and plentiful software, lower-cost systems and peripherals, every micro owner's dream in fact. It will probably be next year at the earliest before software houses have the courage to reduce MSX software prices, depending, of course, on whether MSX takes off in the U.K.
- Judging by the Toshiba MSX system, the decision to purchase one manufacturer's system against another may well rest on a single factor — price.

Database:	
Name:	
Address:	
Pocket-sized	
Re-usable datapacks	
Own program language	
Speedy data access	
Software library	
Rugged construction	
Battery powered	
Permanent data storage	

PSION ORGANISER Competition



PSION'S ORGANISER is a truly pocket sized computer with a built-in database facility. Once you have slotted in an 8K datapack you can use it to store over 10,000 characters permanently. After creating your database you can then access its information in a matter of seconds.

There is also scope for writing programs — using the machine's own language, POPL. Or you could buy one of a range of specialist programs supplied on program packs.

Not least of the Organiser's merits is the fact that the datapacks are inexpensive and can be re-used up to 100 times.

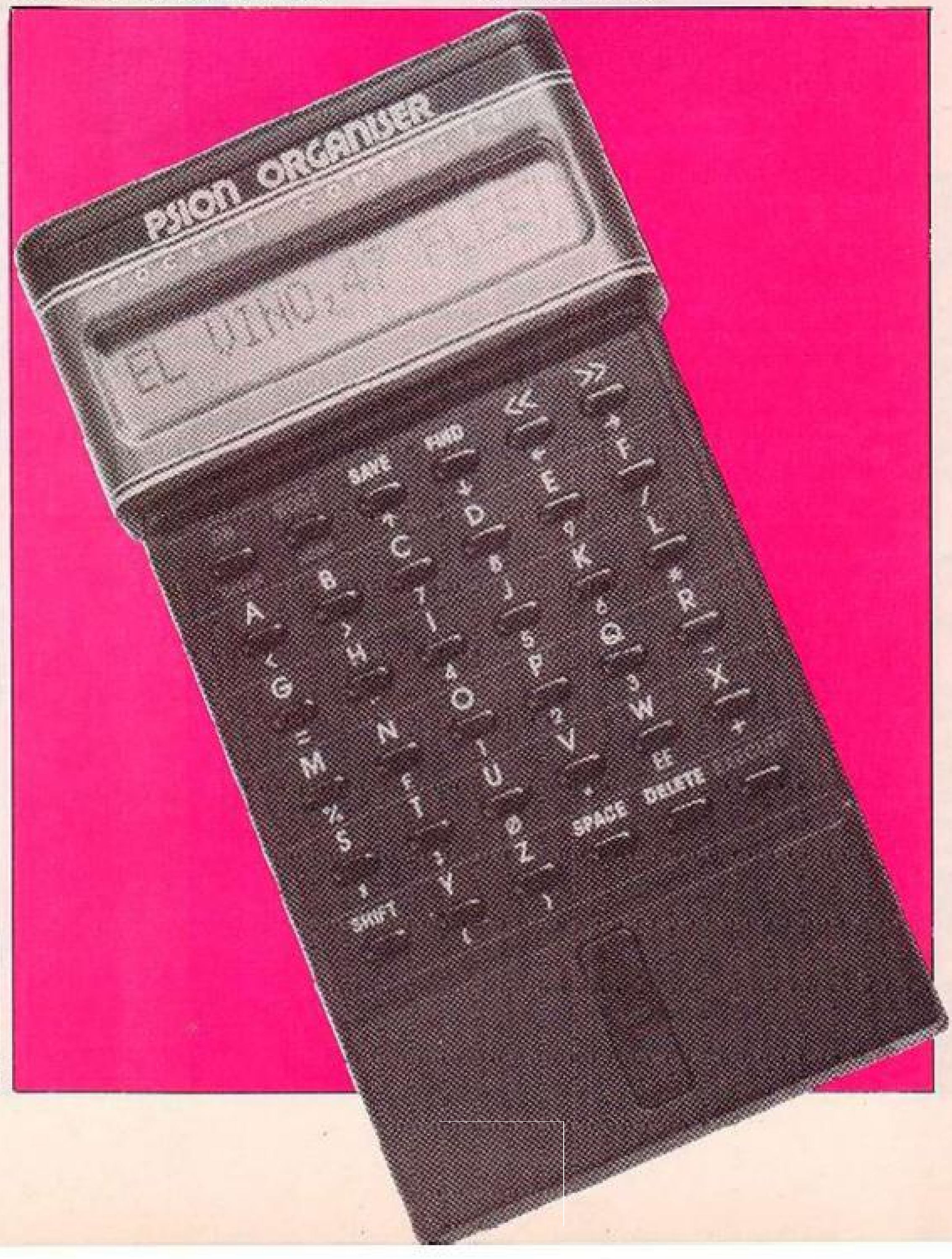
In this month's competition Psion is giving us three Organisers as prizes. Each comes with a Utility Pack and a 16K datapack. In addition the winners will be able to choose one of four program packs: Finance, Maths, Science or Link-Up Communications.

To enter you need to put eight of the Organiser's features in order of importance. Then as a tie-breaker we would like you to suggest an original way of using the database facility — what sort of information would you store in the Organiser's datapack?

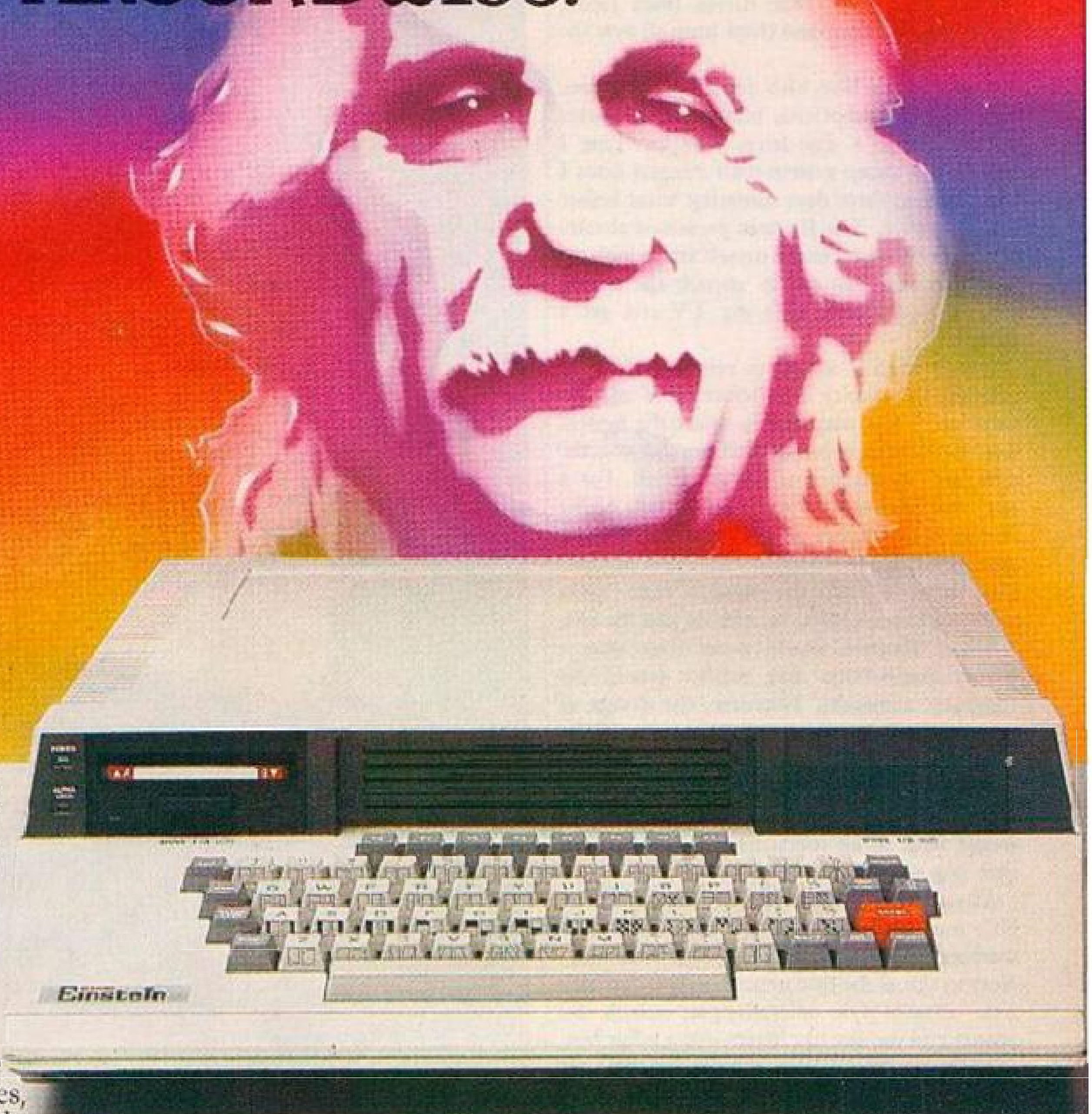
Put a 1 against the feature you consider most important, a 2 against the second most important and so on until you have filled all the boxes. Now think of an original database and send this coupon to Your Computer, L-221, Quadrant House, The Quadrant, Sutton, Surrey, SM2 5AS.

RULES

- The winners of the competition will be the people who number the Organiser's features correctly and, in the view of the editor, make the most original suggestion on the use of the database.
- The names of the winners will be printed in the November issue of Your Computer.
- All entries must arrive at the Your Computer offices by the last working day in September 1984.
- Each person may enter the competition only once.
- Entries to the competition cannot be acknowledged.
- No employee of Business Press International or their relatives may enter the competition.
- The decision of the editor is final.
- No correspondence on the result of the competition will be entered into.
- Business Press International assumes no responsibility or liability for any complaints arising from this competition.



A COMPLETE COLOUR MICRO WITH NO HIDDEN EXTRAS FOR AROUND £499.



The title of 'genius' is not bestowed lightly on man or machine: those extra-ordinary qualities and powers of intellect are rare.

Einstein had them in full measure. And so now does the new micro computer from Tatung, designed and built in Britain and appropriately named – Einstein.

Einstein was created by Tatung, one of the world's leading electronic companies, and given the capacity and the remarkable capabilities to compete with computers costing far more.

Its simplicity of operation will appeal to the first time buyer and to businessmen who don't want to lose staff to expensive and time-consuming training courses. At the same time its operating system is both powerful and sophisticated to satisfy the most advanced requirements.

For those who have outgrown their existing primitive machine, the speed and capacity of the 500K built-in disc drive will make all the difference. And for the small businessman, the ability to store and retrieve all information in seconds will be as important as Einstein's built-in flexibility, which allows the system to grow as the business develops.

BUILT-IN 80K MEMORY
Total memory capacity 80K RAM divided into 64K 'user' memory and 16K for colour graphics production.



BUILT-IN DISC DRIVE
500K 3" compact floppy disc drive. Potential for massive extra storage with a second 500K disc drive internally.

BUILT-IN 16 COLOUR GRAPHICS High resolution graphic animation from 32 sprites (definable shapes), 16 vivid colours.

BUILT-IN EXPANSION PORTS
Connection to both TV and optional colour monitor, most printers and other computers via RS232C interface. Also twin joystick ports, 8 bit user port, exclusive Tatung Pipe.

BUILT-IN FLEXIBILITY
Powerful Crystal BASIC. Multi-lingual plus ability to run CP/M.†

BUILT-IN VERSATILE SOUND
Sound synthesiser facility includes chromatic music with three voices. Substantial speaker with volume control. Provision for speech synthesiser.

Einstein has them all. Feature for feature, it meets the needs of the novice and the experienced operator, both at home and in the office.

Einstein, designed and built in Britain, is a complete colour micro computer with no hidden extras.

And for under £500 is sheer genius.

TATUNG

Einstein

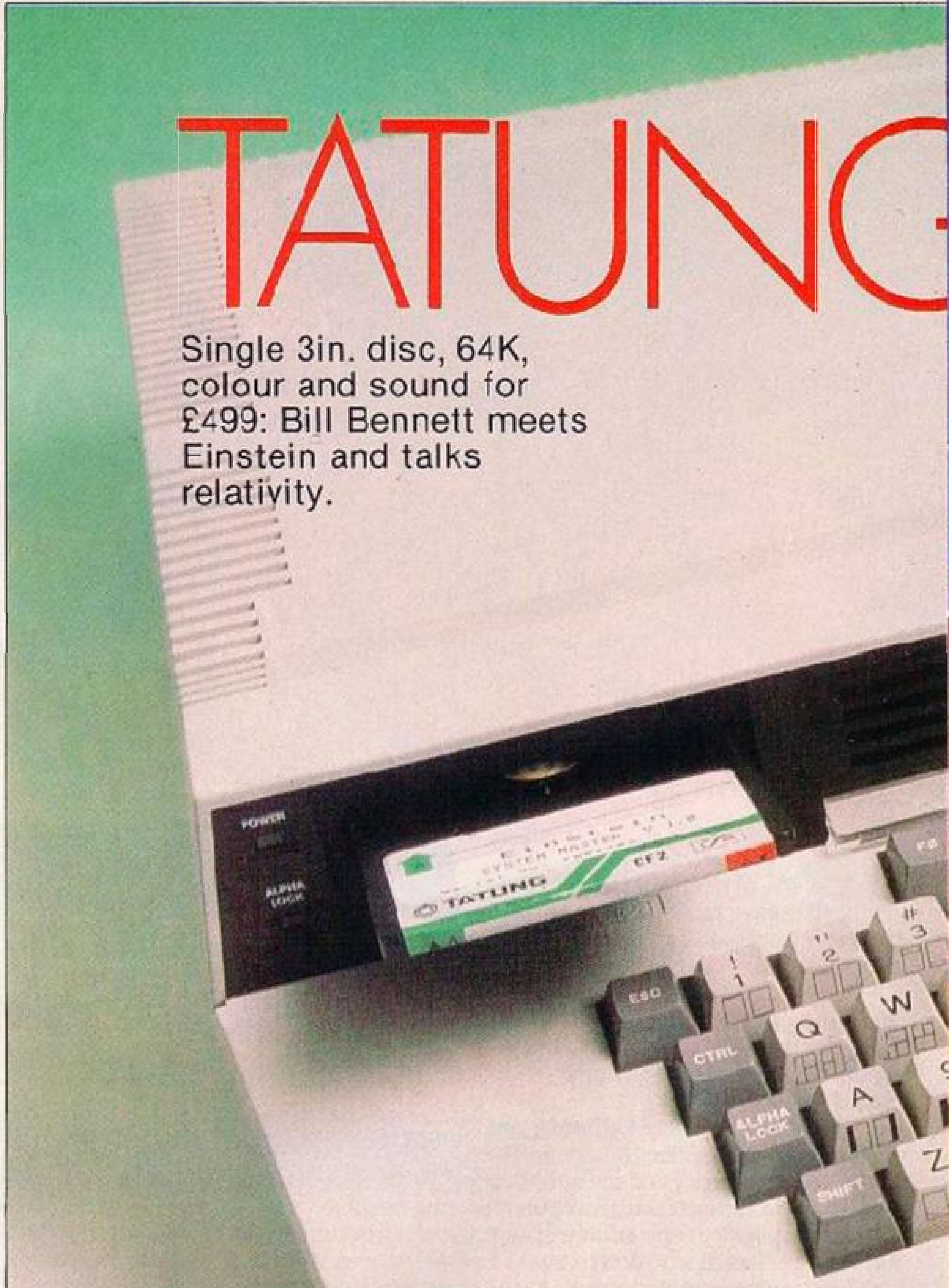
SHEER GENIUS: AT WORK, AT HOME.

DIAL 100 AND ASK FOR FREEFONE EINSTEIN FOR YOUR NEAREST STOCKIST.

†CP/M is a trade mark of Digital Research Inc

TATUNG

Single 3in. disc, 64K, colour and sound for £499: Bill Bennett meets Einstein and talks relativity.



YOU WOULD NEVER guess it from the name, but the Tatung Einstein is a British micro. Made by a Taiwanese company based in Shropshire and named after a German, Jewish, American scientist, the Einstein is the usual electronic cocktail of exotic components from around the world. Disc drives from Japan, Basic from Torquay and chips from all over the shop.

I opened the box with some apprehension. Here was a mid-priced, mid-range computer complete with a disc-drive. The last time I looked at a cheap system with integral discs I had to spend three days soldering wires before it would work. The Einstein presented absolutely no problems. I timed myself and it took me less than two minutes to unpack the micro, plug it in, connect it to my TV and get a picture.

It took slightly longer to retune the TV to optimise the display but, before three minutes were up, I had managed to insert the system disc that comes with the machine, and load the directory. A number of things helped. For a start the plug was already connected. Many micros come without plugs so you have to hunt around for one to "borrow" for the computer. But, most of all, the integral disc saves worrying about cables, interfacing and the like.

Albert Einstein would never have won a beauty competition and neither would his computer namesake. However, the design of the machine is elegantly utilitarian. It is moulded out of a fairly tough-gauge plastic so you can comfortably sit a monitor or TV on top. I would not recommend this though as you would have to sit much nearer to the screen than is good for you.

Above the keyboard are two LEDs that do little more than tell you that the computer is working and what mode the keyboard is in. Next to this is the disc unit. It accepts the little 3 in. Hitachi-style microfloppies which are posted into the slot like letters into a pillar box. A button below the slot unposts the discs for you when you need to swap them.

There is a space on the right-hand side of the machine to add an extra disc unit. This would be almost essential if you were using the Tatung as a workaday business computer but a bit excessive for the home user. Between the disc and the potential disc is a grill which I thought was probably there to help aircool the insides. It turned out to be a loudspeaker, loud being the operative word.

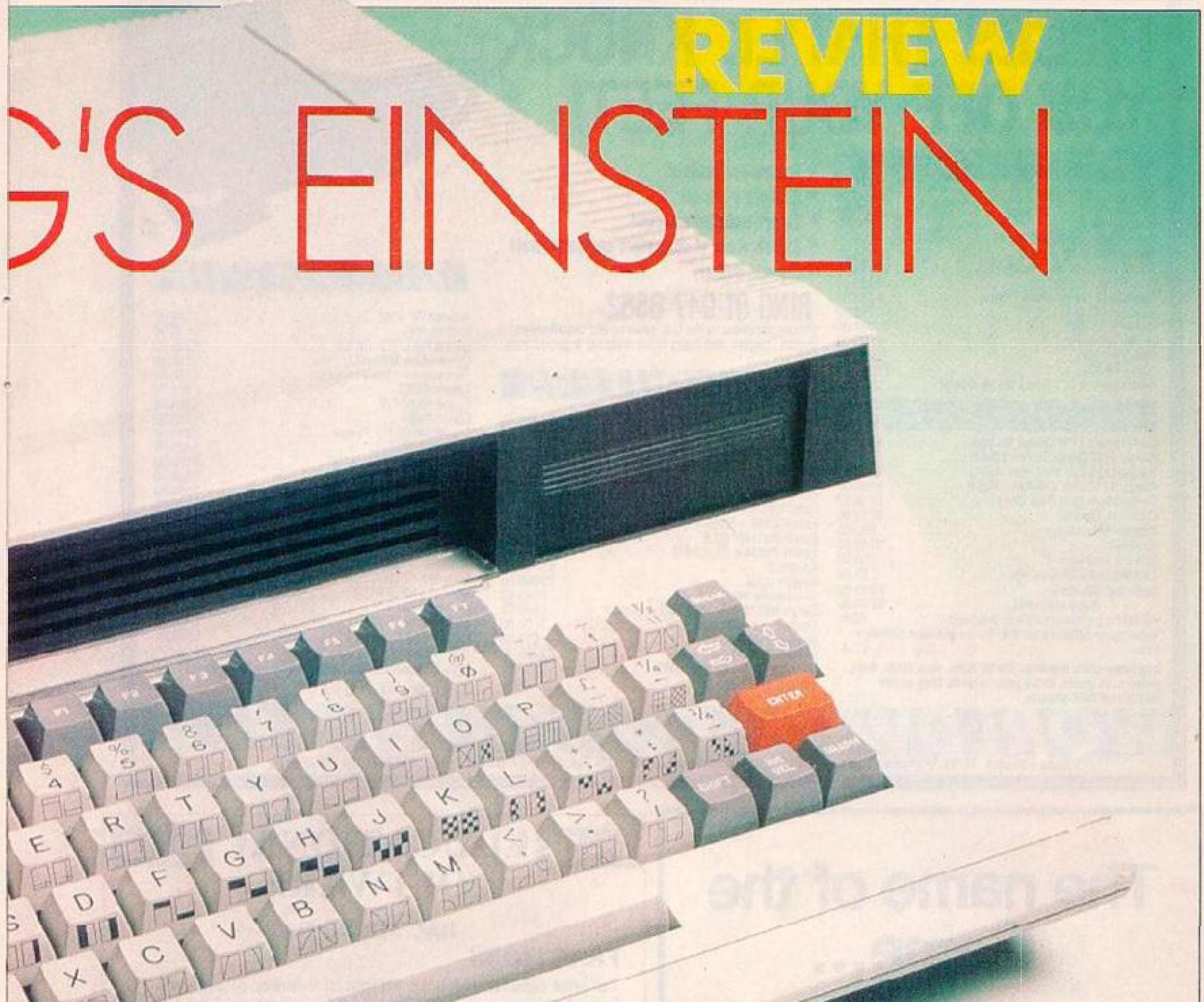
I thought that the Oric was a touch strident with its built-in speaker but the Einstein is positively in the Motorhead class. In front of this is the keyboard. Topped by a row of seven function keys, the keyboard contains no surprises. I don't like to see the graphics characters printed on the front of the keys, it looks messy, and most people only use them occasionally anyway. However, it does seem to be de rigueur in micro circles. I doubt if anyone will miss the Tab key, which the Einstein doesn't have.

Along the rear of the micro are a number of interfaces. If you are going to make use of them I would suggest that you find a permanent home for the micro. They are not the sort of things that take kindly to being constantly plugged in and unplugged. There is, of course, a printer port, an interface for more disc units, up to a total of four drives and a user input output port. Just what you need to run a power station or a cruise missile launcher.

Right in the middle of all these ports is something called the Tatung "pipe". It sounds like a copy of the Acorn "tube", but is much nearer in concept to the port on the back of the humble Spectrum. Like Sinclair's port, the pipe is not much more than a simple extension of lines from the Z-80.

Down the right-hand side of the machine are two more ports. Ostensibly these are for joysticks, but are actually analogue to digital converters. If the Tatung Einstein has one obvious application, it is in the science laboratory. With all these ports around the machine it would be excellent for the control and monitoring of experiments. It is a pity the micro is named after a theoretical scientist, when it has so many

G'S EINSTEIN



practical features

Next to the analogue ports is the almost obligatory RS-232 port, though it uses a DIN socket so you will have to worry about soldering your own cables to make use of it. And, best of all, a volume control knob. Until I found this, I actually had a neighbour come round and complain about the noise.

Nobody will be surprised to discover the TV output on the right-hand side of the micro's case, but I was disappointed to find that there is no monitor output. A computer with as many user ports as the Tatung Einstein could do with a simple RGB output as well. There is a special Tatung colour monitor to go with the Einstein, costing £240, but because there is no RGB output you cannot easily use any other manufacturer's monitor.

The Einstein is a "soft machine", that is its resident language and operating system are not actually resident at all. They come on disc and are loaded into the machine in a ritual the user must perform each time he or she uses the micro. Yet there is an 8K ROM which includes the machine-code monitor system. This makes the Einstein an attractive micro for the enthusiast but hardly ideal for the beginner.

Should you want to develop machine-code software, you could do so without ever entering the disc operating system. But most people will want to use Basic at some time and it has to be loaded from disc. To do this you must first load the disc operating system or DOS.

XtalDos is the operating system used by the Einstein. Because it comes supplied on disc, there is no reason why you couldn't use another operating system. No others are available at the moment, but should XtalDos mark II appear, or should some enterprising programmer devise a version of CP/M for the micro, you will only have to pay for that disc.

XtalDos is remarkably similar to CP/M, so much so that I managed to get started knowing only CP/M and not XtalDos. But XtalDos — pronounced crystaldos — is not CP/M and will not run all CP/M software. This is a bit naughty because on the computer's box is the boast: "Ability to run CP/M software". There are more than 5,000 CP/M software packages available so you could be forgiven for thinking that buying an Einstein gives you access to a huge back catalogue of programs.

The Einstein does have the ability to run some CP/M software, it is just that you cannot buy genuine CP/M for it yet. What is more, it will not be cheap when it is available — CP/M system discs generally cost around the £50 mark. Further to this is the fact that, as yet, there is no CP/M standard for 3 in. discs. This means that even if there was a true implementation of CP/M for the Einstein, you would not be able to stroll down to your neighbourhood store and buy a software package off the shelf with any confidence that it will run on your micro.

I hope that someone does implement CP/M just as soon as the 3 in. standard is decided because, quite frankly, XtalDos is a minority operating system. There will never be enough

(continued on page 55)

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(continued from page 53)
XtalDos systems in circulation to justify a large software base.

There is one other possibility. The Einstein is physically able to run MSXDos. The micro has most of the right hardware and it would be a logical direction for Tatung to move in.

Despite my severe reservations about minority operating systems, XtalDos is jolly neat. So is Xtal Basic, the native language of the Einstein. It has met with a degree of acclaim from programmers but is not a good language for beginners. I found that it contained a lot of commands that could be found elsewhere but are not standard.

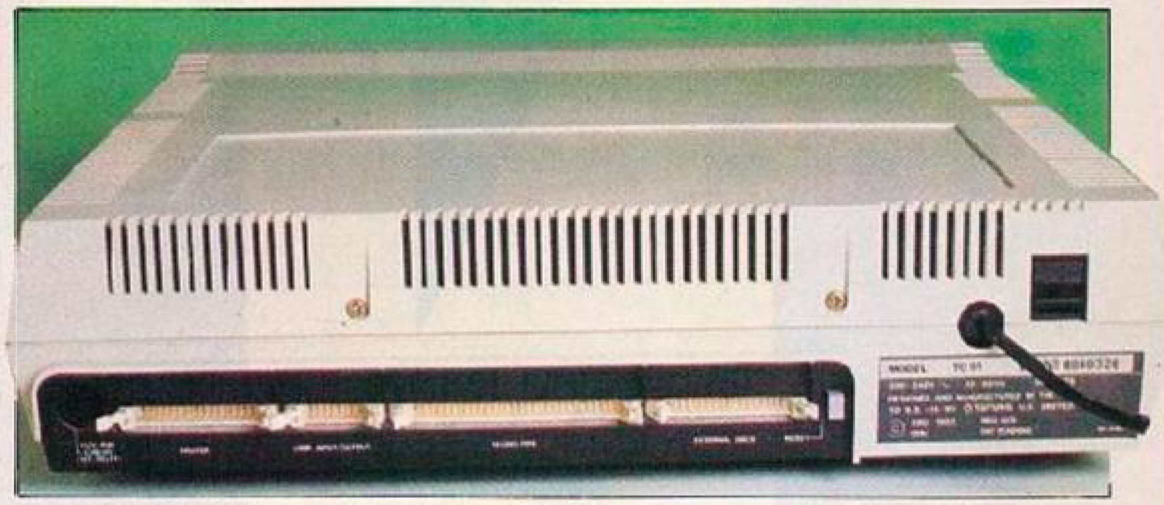
Xtal Basic may be better than other Basics but there will be precious few games listings published in it and there will be hardly any good books about it. But, again, because Xtal Basic comes on disc and not ROM, it is an option. There is no reason why standard Microsoft Basic could not be implemented on the Einstein or, for that matter, Forth, Pascal, Prolog or Logo. Any versions of these languages developed for CP/M could be adapted fairly easily, though it might not be an economic proposal.

The system disc comes with a few example programs which don't show the Einstein off to its best advantage. I realise that Tatung must have bent over backwards to trim the costs to achieve the sub-£500 price tag, yet it would have been so much better if the supplied software was more imaginative. The Othello game was easy to beat and the snakes game downright boring.

I may be asking a lot but for this price I would like to have a second disc containing a word processor and a spreadsheet. This way you would be able to buy a complete system, ready to work or and for a good price.

Xtal Basic is not new, I remember seeing a version ages ago on the Sharp MZ-80K. It has a lot more commands than common or garden Basic, complete with things like Deek and Doke which are two-byte versions of Peek and Poke, strictly for the enthusiast. However, Xtal Basic is very good at handling the sound and graphics of the Einstein.

Sound is often the Cinderella feature on a computer, so my heart naturally warms to Tatung's serious treatment of it. The Basic commands and the sheer volume and the flexi-



bility of the hardware are all plus point for Tatung. Unfortunately, the other half of the sound and vision equation is not so good.

For a start, the colours are dingy. The red is more like a washed out pinky orange than the colour of the people's flag and the blue just isn't true blue at all, but a weedy purple tint.

The Basic commands controlling graphics are extensive and flexible enough and 32 sprites should keep most zappers in aliens for days. Apparently, the Einstein uses the same video chip as MSX machines. If that is the case then the Japanese invasion will be nothing to fear because the high resolution isn't all that high, the colour not very colourful and the sprites none too spritely.

Maximum resolution on the screen gives 192 by 256 pixels — hardly high resolution for a £500 micro. There are 16 colours but, because they are so dull, it is difficult to tell some of them apart. Although they are easy to control from Basic it isn't enough for 1984's model.

While the graphics might be a little disappointing from the point of view of the games player, they are not all that useful for the business user either. You can select either 40 or 32 columns across the width of the screen, but both sets of characters do not look as attractive as those to be found on other micros. More importantly, I found my eyes were feeling the strain after about an hour's use. So word processing — which anyway should really have 80 columns — on the Einstein might not be a serious proposition.

The colour resolution of the Einstein is only to the nearest character position. That is colours are defined on a 32 by 24 or 40 by 24 grid. This is about the same as on the Spectrum — hardly impressive. Drawing a diagonal line results in the chunkiest graphics you have ever seen because the lit pixels fill the whole of their row within a character space.

The manuals don't help much either. They are so unbelievably boring that I thought they must have been written by Jeffrey Archer.

The "DOSMOS" booklet, now there's a name to conjure with, is much more useful than the introduction book yet every bit as dull. It contains information about the machine code monitor and how to use the disc operating system. A third book is supplied with the machine called the Basic Reference Manual. It is the programmer's bible, yet suffers from the same shortcomings as the other two books; it is dull, contains no index, and no sensible appendices. It should at least contain a section full of memory map diagrams, screen address diagrams and the like.

I was impressed by the inclusion of a quick reference card, similar to that sent out with the Dragon 32. However, it turned out to be not as useful as I expected with no adequate description of the Basic keywords. This would be especially useful as certain Xtal Basic keywords are slightly exotic.

Although I have reservations about this micro, it does compare favourably with other systems in the same price range. The machine sits uncomfortably between computers like the BBC Micro, which is definitely a home computer with business possibilities, and the £700 ACT F1 which is a business computer with home possibilities. You can now buy a BBC for around £350 or less. It has better graphics than the Einstein, similar sound, better Basic and better manuals. But it doesn't have discs, nor does it have as much memory as the Einstein which comes with a full 64K plus 16K of video RAM. In practice this means a 64K memory, because the video RAM lies parallel to the main RAM.

Although the BBC has a wide user base and all the advantages that brings, add-ons are expensive. The Einstein will be able to use standard add-ons thus reducing costs considerably. If you want compatibility with educational users the BBC would be a better buy, but hackers might choose the disc-based system.

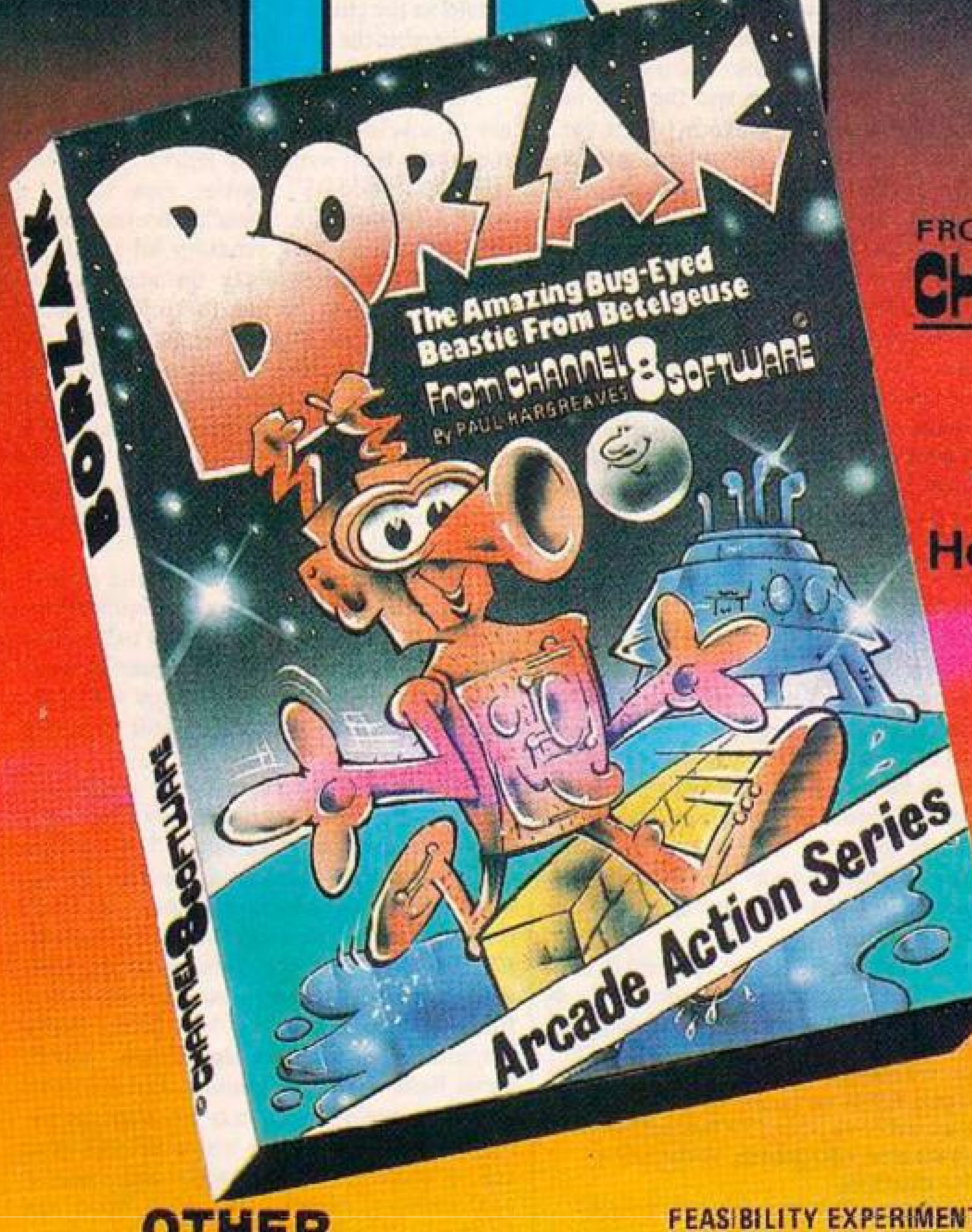
Compared with the Sinclair QL, the Einstein is not very racy, but its 3 in. discs are a sight more standard than Sinclair's Microdrives. They are also more useful, more likely to last and can hold more — 190K per side as opposed to 100K per cartridge. If you want to play games the QL will be a better bet but for serious use the Tatung should win. ■

CONCLUSIONS

- The Einstein does not fit into the current spectrum of available micros very well being neither a good enough games machine nor a powerful enough business system. The cop-out answer is that it is an educational computer but that is one role it is particularly unsuited to fill.
- Anyone purchasing the Einstein may have to reconcile themselves to owning a ghetto machine. I cannot see the dedicated software base ever getting large enough to be anything else. And as for CP/M compatibility, someone is going to have to copy each package across into the Einstein disc format and, in many cases, rewrite the software for the 40- or 32-column screen.
- In my opinion there is a serious design fault. Had the disc drive been a standard 5¼ in. unit, then users would have immediate access to all the available CP/M software. I realise that this would have added to the cost but it would also add greatly to the utility of the machine.
- There is one other problem that will be familiar to owners of the Sharp micros which have a lot in common with the Einstein, thanks to versions of Basic not stored in ROM. Should Tatung ever be tempted to make changes to Xtal Basic — the installed version is 1.11 — then software may no longer be transferable between machines.
- All these reservations aside, the Einstein is a very low-cost way of buying a disc-based system. It is built from reliable tested technology and is unlikely to have the teething troubles of the QL. It is especially suited for control purposes and will thrill the hacker with its Xtal Basic and extensive machine-code monitor.

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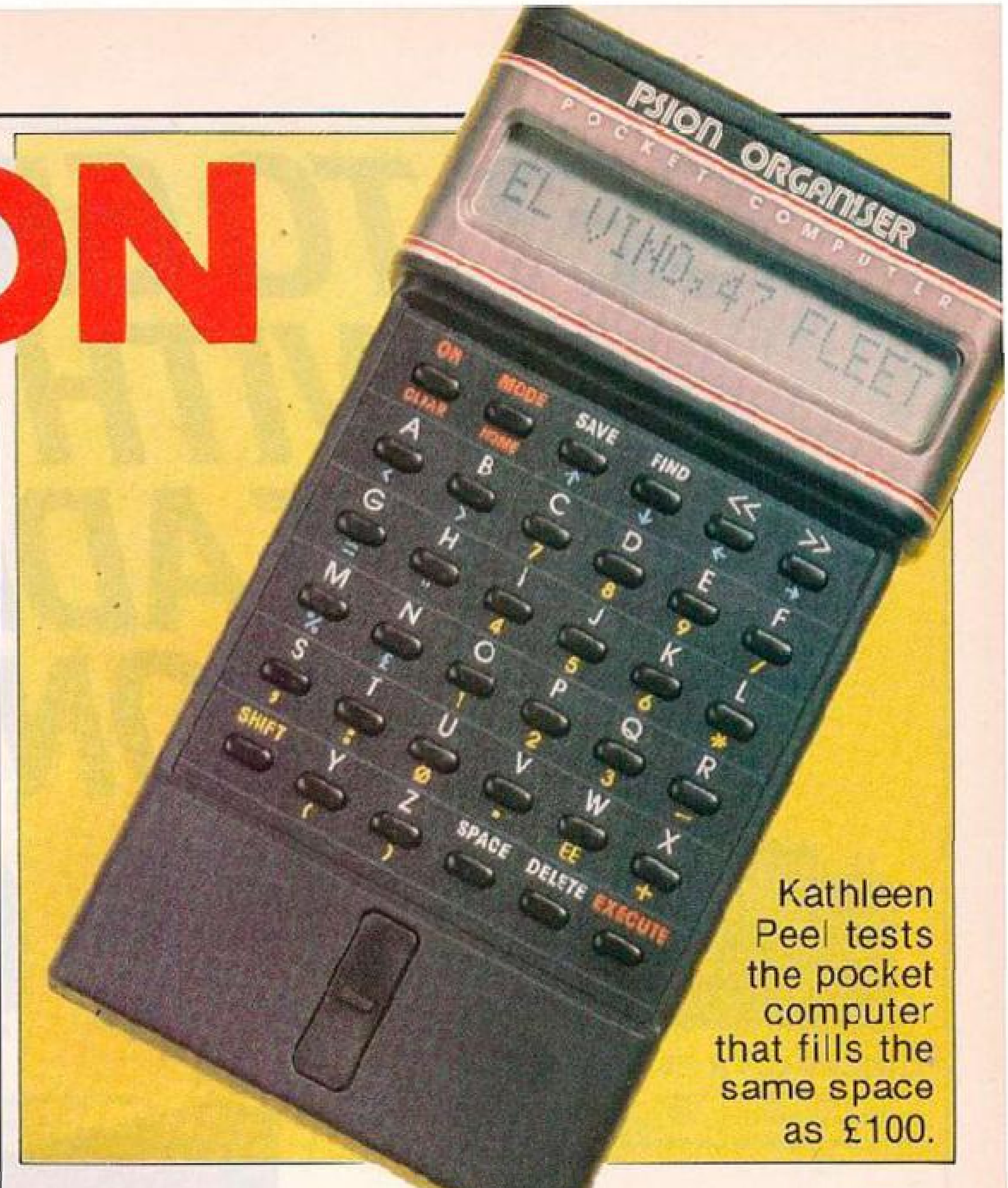
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PSION



Kathleen Peel tests the pocket computer that fills the same space as £100.

ORGANISER

PSION, THE SOFTWARE COMPANY that produces much of the Sinclair Spectrum official software and the bundled software — Quill, Archive, Abacus and Easel — for the new Sinclair QL, has branched out into the computer hardware business, an area that has seen many recent failings by both large and small companies.

The excursion into the apparently risky hardware manufacturing side of the business comes about by the desire to produce what Psion describe as a new type of computer product called the Psion Organiser.

The Psion Organiser is a calculator-sized pocket computer featuring a 16-character LCD display, a 36-key keyboard and an 8K plug-in Eprom memory pack or datapak. The calculator-type keys are protected while in the pocket by a sliding cover which, when withdrawn, exposes the plug-in memory underneath the keyboard and the display contrast adjuster control on the right-hand side of the display. Complete withdrawal of the cover gives access to the PP3 9 volt battery compartment.

The computer is based on the Hitachi 63C1X CMOS 8-bit processor, which contains 4K of on-chip ROM. This is supported by 2K of RAM for the calculator working registers, system variables and an 8K Eprom for program and/or data storage.

For £100 the user gets a bare bones calculator with a 15-character alpha-numeric LCD display — no scientific functions with parenthesis limited to a depth of two — and a built in database facility, capable of searching the 10K of character storage — 8K Eprom — for a specific number or character string within five seconds.

The Organiser is activated by using the On/Clear key and powers up with the display showing the time, date and month. The time may readily be adjusted as indeed it needed to be. The machine provided for review stopped the real-time clock from running when the machine was switched off, the replacement machine had no such problems.

The Mode key selects the current operating mode, that is:

Enter for general purpose free format database entries and editing.

Call for performing calculations.

Off which the user Executes to switch off.



Each individual process is performed by use of the Execute key — calculations are entered in the normal manner and the Execute key pressed instead of the more usual calculator = or Enter key.

Data is simply typed while in the Enter mode using the alphanumeric keyboard, each file being saved using the Save key with the display indicating whether the data is saved in datapak 1, or 2 if two datapaks are installed, according to the user's choice.

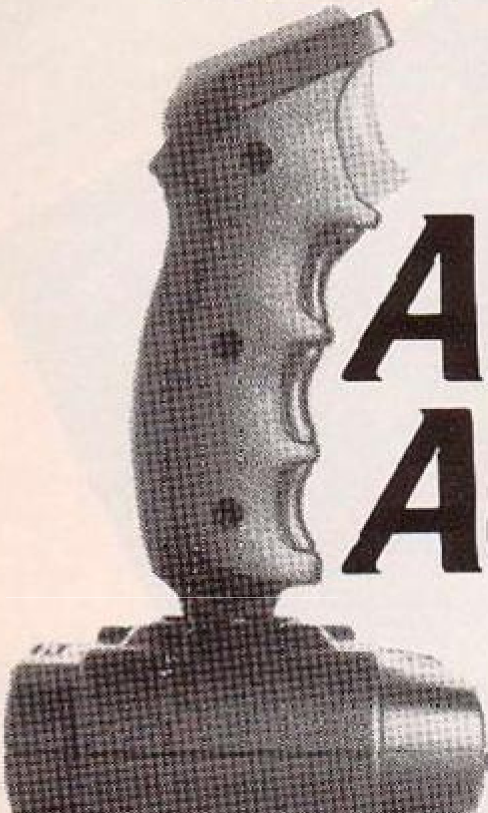
The database needs to be fairly static, data changes simply overwrite the existing data in memory to make it unreadable and the new file is written into a clean area of memory. Fast changing databases will become extremely wasteful of memory.

The database in each datapak must be consistent; the user can store telephone numbers, train timetables and appointments together within one datapak but there is no way of restricting a search to a specific segment or groups of files in an individual datapak.

Find2 string$ will find every occurrence of string$ within all the databases in datapak2. Therefore as an electronic notepad, the user is required to keep with the Organiser all the necessary databases separately which could

(continued on page 59)

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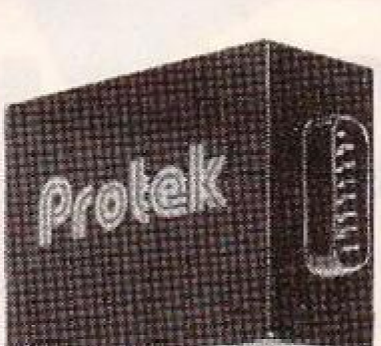
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(continued from page 57)
become expensive in terms of datapak cost, and add considerably to the amount the user has to carry around.

The 8K Eprom can store about 200 names, addresses and telephone numbers. A search may be conducted using the Findn string$ function, every record containing string$ will be displayed, otherwise the computer keeps searching for a match. If there is no match, the message "not found" is displayed. If a string$ is not given for the search, the computer will step through every file within the database.

By adding a program pack — £30 Finance, Mathematics or Science Paks are available — the Organiser is provided with further modes of operation:

Copy for copying between datapaks.
Cat used to access programs.

The Organiser is also capable of performing the same trigonometrical and scientific functions as found in the more comprehensive calculators.

And lastly a procedural language POPL is added. Each procedure is limited to a length of 200 characters, with an individual line not exceeding 100 characters. POPL supports 26 variables and can pass parameters between procedures — there is Goto a label and looping facilities.

Under normal conditions, rewriting code is not a problem as the program storage media is reusable. With the Eproms it is not and once written to, that space cannot be re-used until the datapak is re-formated which clears the whole of the datapak ready for a fresh start.

The Organiser may be expanded to incorporate two 16K Eprom datapaks, these cost £20 each but increases them in memory storage capacity up to 40,000 characters. The user may install 8K Eprom datapaks which cost £13, but either way strikes me as being pretty expensive for storing data.

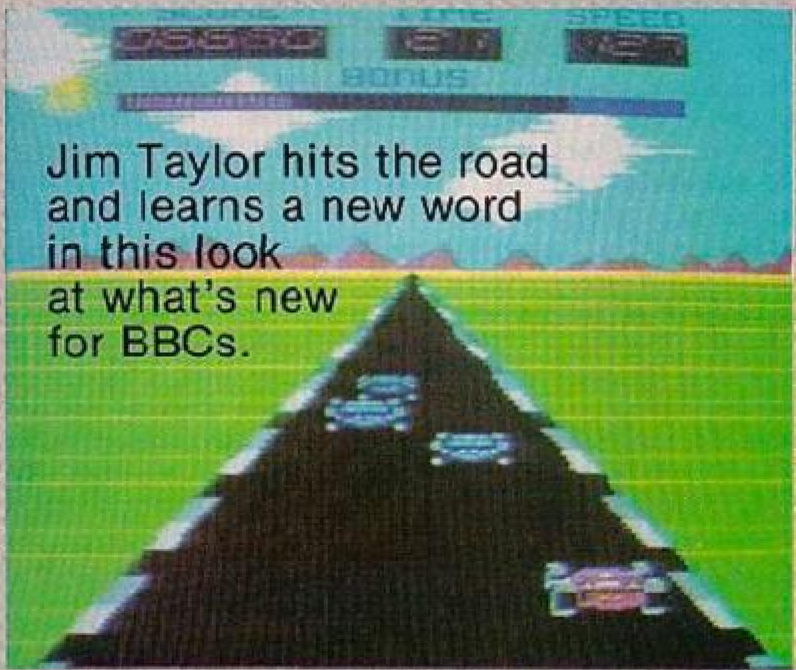
The datapaks may be reused up to 100 times by reformatting — wiping clean all of the Eprom; remember you cannot selectively erase. This will cost £3.50 if done by your local stockist or the large user may purchase a Formatter for £45 which can reformat two datapaks in 30 minutes.

The manual supplied is 1/4 A4 size of about 50 pages of text and diagrams. Most details are explained twice but for those who so far have shown no interest in computing, the documentation will be difficult to understand. The average computer user will find no problems other than the programming requirement of learning yet another language, POPL, which can hardly be of use in any other context.

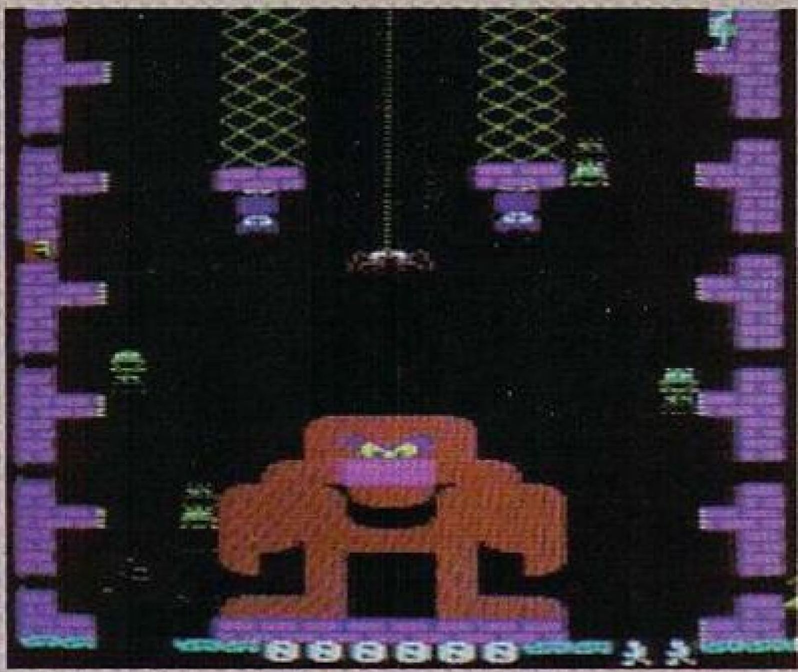
The RS-232 expansion unit, which costs £25, permits the user with a modem to downline load data via a telephone line to a remote computer. Computer to computer data transfer is also possible. ■

CONCLUSIONS

- Although very simple to operate as a database with a single integrated data file, the Organiser cannot handle separate databases residing on the same datapak.
- The database being searched needs to be fairly static, if it is going to change daily as a stores inventory might do, then the necessary changes to the database are going to use up the available memory space extremely quickly.
- Program development is likely to suffer the same fate. It is not possible for a user to write and enter a program without faults, and the Organiser will allow the user to work on only one procedure in RAM at any one time.
- The Organiser is going to be very expensive to run as a computer. The development of software which is always subject to change and revision does not lend itself to the type of storage media employed in this computer design.
- The use of Eproms as the storage media imposes restraints on the programmer, a requirement for a local Eprom formatting service and fairly substantial power requirements on the hardware designer.
- The Organiser appears to fit those types of market where data security is essential and, of course using Eproms gives a very high level of security, but logistically I'm not sure. The data typed in is secure, but whether it can be entered correctly using the calculator-type keyboard and very small screen display without a lot of careful checking at the time of data entry, which the average person is unlikely to perform, is doubtful.



Jim Taylor hits the road and learns a new word in this look at what's new for BBCs.



BBC SOFTWARE

FRAK! A NEW WORD enters the English language, courtesy of Orlando and Aardvark Software. Use it when you're frustrated, when you drop your toast jam side down or simply when you lose yet another life playing the compulsive new game with the title Frak!

It's a bold change for Orlando, the programmer who brought you the classic shoot'em-up Zalaga. There's no frenzied and murderous action in this latest offering, just superb graphics and a witty variant of the platform game.

You are cast in the role of Trogg, a caveman with a belly worthy of a champion darts player. Trogg's forte, though, is the yo-yo, with which he can knock the various monsters off their perches.

On the first screen his opponents are the Scrubblies, large purple creatures who just get in the way without being at all aggressive. On the second screen, should you ever get there, you will find Poglets squatting on logs and on the final screen are Hooters which have the prominent facial feature suggested by their name.

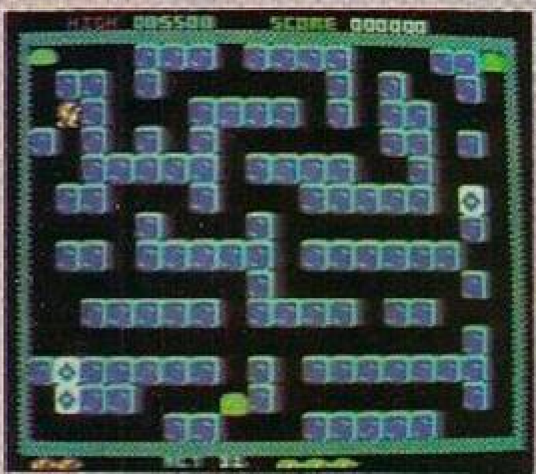
Throughout the game there is danger in the form of balloons floating up and daggers drifting diagonally across the screen. As you climb ladders and hop along platforms it's difficult to avoid them. Each time you lose a life a cartoon-style balloon emerges from your mouth as you utter the fatal word 'Frak!'

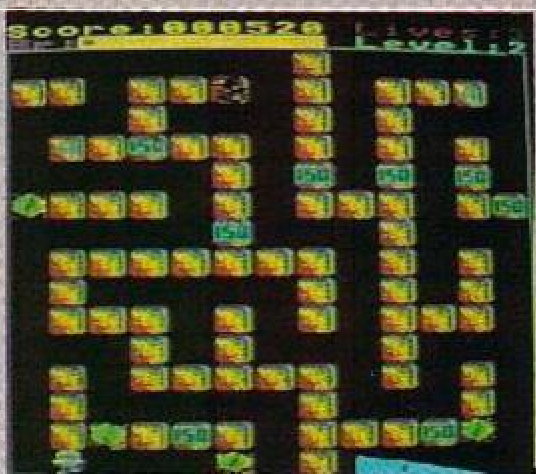
The gameplay in Frak is consistently entertaining and, although quite a simple idea, provides a real challenge. But the game is remarkable chiefly for the quality of its graphics — they are undoubtedly superior to anything else currently available on the BBC.

Trogg is drawn in great detail even down to the stubble on his Neanderthal chin. The monsters are original and colourful and the game scrolls with exceptional smoothness. Frak! makes most other games look prehistoric.

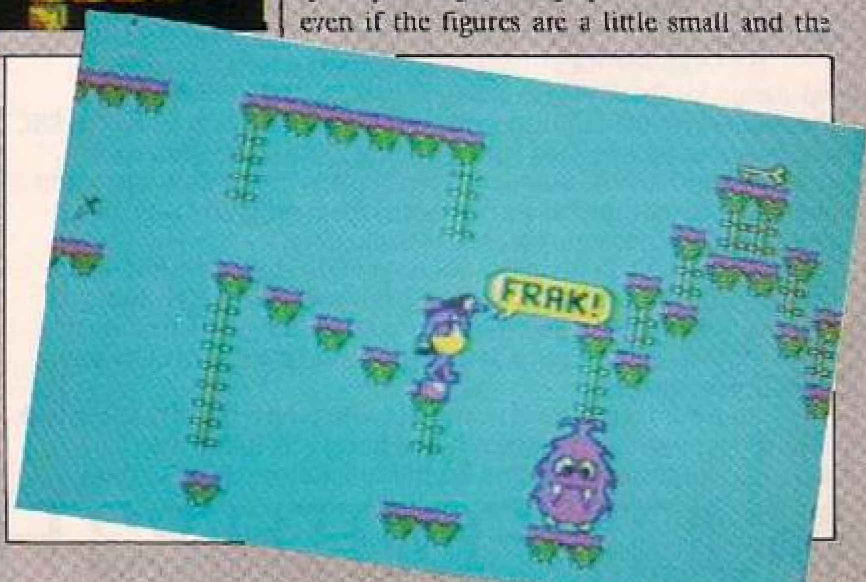
For instance, Microdeal's Arena 3000. This is supposed to take place in 3000 AD, but games don't seem to have come along much in all that time. What you get is a version of Robotron, the rush-your-little-man-around-the-screen-shooting-everything-in-sight game.

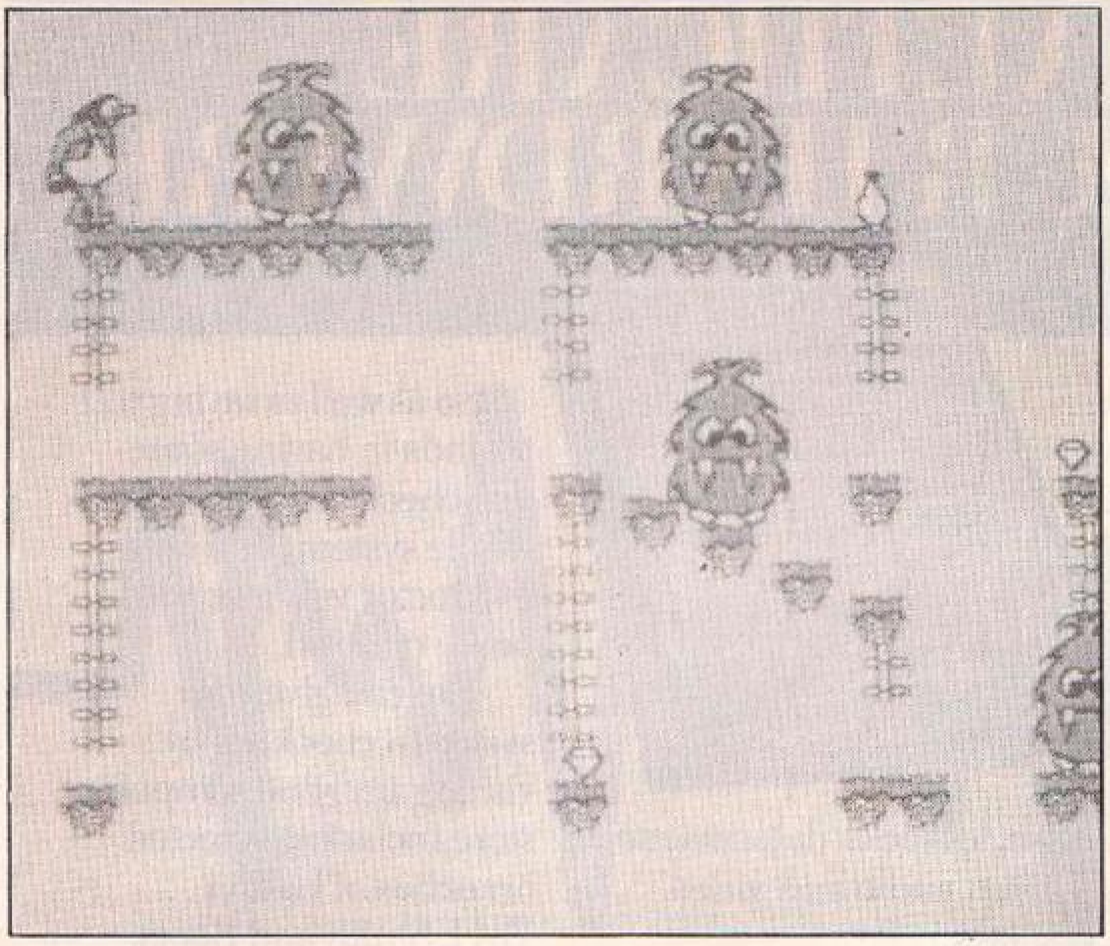
As such, it's not bad. Everything happens quickly enough, the graphics are reasonable even if the figures are a little small and the











movement is pretty smooth. But it's completely unoriginal and, ultimately, pretty boring.

If that other arcade classic, Pengy, is more your style then you will be spoilt for choice: there are no less than three versions in the recent releases. In Pengy you are a penguin who must push around ice-blocks to crush your enemies the Sno-Bees, as well as performing other tasks such as lining up special blocks.

Visions' Pengi is a very good version of the game. 'Poor old Pengi is locked up in the freezer again!', and your job is to line up the ice diamond blocks and crush the nasty Snow Bees, rotund monsters with large noses.

Pick up a penguin

A bonus in this version is that the perimeter of the screen is electrified so that Pengi can fry Snow Bees if he can lure them onto it. The game has good colourful graphics and moves very smoothly. The music is sprightly, keys are user-definable and there are up to 30 screens.

Competition comes in the form of Percy Penguin from Superior Software. The idea is virtually the same, but the execution lacks the sophistication of the Visions version.

The Sno-Bees are again blobbish creatures, but they now have large floppy ears which give them an incongruously cuddly appearance. There's no electrified fence, the colours are not so vibrant and the movement is slightly jerky.

Better than both these versions, though, is Program Power's Rubble Trouble which represents a great leap forward in the theory and practice of Pengy.

In this game there are no penguins and no Snow Bees. Instead, the post-holocaust scenario gives you a caveman battling it out with the Krackats, 'mutated turtle-like creatures' who hatch from the rocks which have replaced ice-blocks.

The principle is the same — crush your enemies — but the innovation is that the boulders bounce back if they don't get a Krackat. They move so quickly that you're likely to splat yourself if you're not careful.

The graphics are excellent, with a bland caveman and very nasty green Krackats. Movement is very smooth and when you lose a life you ascend to heaven with a halo. It doesn't take too much imagination to turn a tired old game into something which seems almost original.

Original is not an adjective which could be applied to Simonsoft's Super Fruit. It is, of course, a one-armed-bandit simulation, and a very good one at that. It provides all the expected options and has excellent graphics and sound. The main virtue of this program, though, is that it moves particularly smoothly. If, for whatever obscure motive, you want to play a fruit machine on your BBC, you are unlikely to find anything better than this.

There haven't been too many motor-racing games available on the BBC, but Superior Software has just brought out Overdrive while Program Power is now offering Stock Car.

Overdrive is a multi-stage 3D race through ice, snow, desert and riverside. You must first qualify for the race by finishing in the top 12 — no easy task to begin with. You begin on the black track heading straight as an arrow through the green fields to the red mountains in the distance. Accelerate quickly or you'll get flattened by the other vehicles coming from behind.

Graphics are good and the motor noises are most convincing. The game is challenging enough to keep you at it for quite some time.

Stock Car's graphics are much cruder — blobs on a track seen from above — but the fun of the game is a little more robust. As in the real thing you try to get round the track first while causing as much damage as possible to other competitors.

There is a choice of six tracks and you can also get optional hazards such as oil slicks and skids. Playing against the computer can be a bore, but competition with another humanoid is much more exciting.

Ghouls, from Program Power, is not only exciting but infuriating as well. You have to rescue your power jewels from a creepy mansion on top of a hill. There are four spooky screens to battle through, although I have yet to meet the man who has successfully completed this game.

Ghoul dodging

You are required to jump over gaps, walk on magic platforms and dodge the ghouls. It is all pretty difficult. Although your little yellow man is plucky enough he's really up against it. The grotesque red blob of a ghoul descends slowly from the top of the screen; when you snuff it he actually smiles while the sound produces a derisive whine. Everything about this excellent game is calculated to have you making frequent trips to the keyboard and the drinks cabinet.

Jet Power Jack, also from Program Power, is just as well made, with excellent graphics and sound, but is not such a compulsive game.

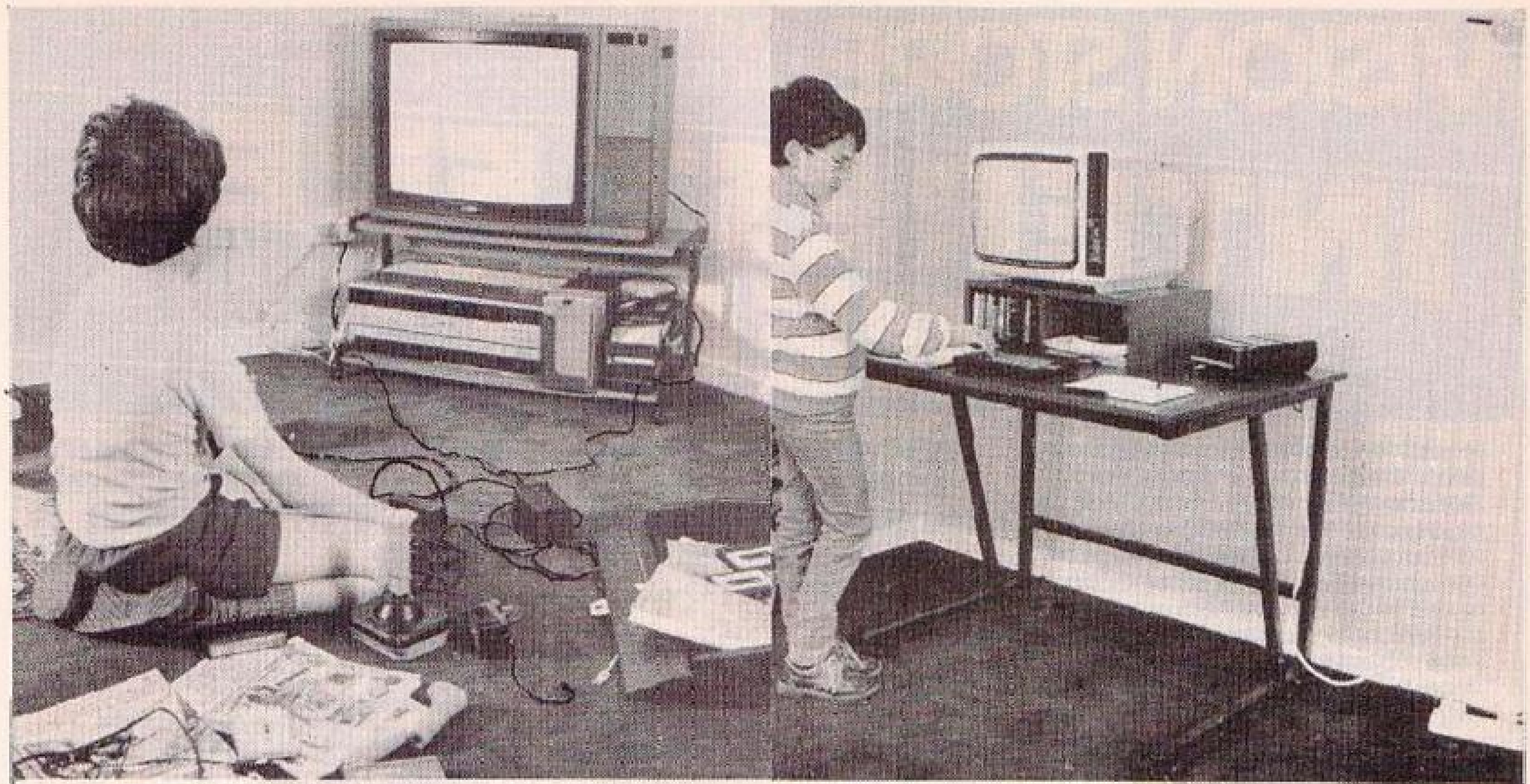
Your task is to collect fuel pods scattered around the space garage in which Nogrob the Terrible has imprisoned you. On your back is a turbopack which allows you to thrust around and avoid, if you're lucky, such opponents as the "nasty space Googjies".

There are five screens and a great variety of creepy space monsters to overcome until you get through to Wilfrid the hideous Yugg monster at the very end. Inventive and colourful graphics give this game its high quality, but you should be warned that the thrust controls take a considerable time to master.

Landscape with tanks

In Dynabyte's 3D Tank Zone colour has been sacrificed for high-resolution — to good effect. The game is a Battlezone variant. Through the windows of your command centre you scan the landscape for enemy tanks, get them in your sights and then blast them to bits. Very satisfying when it comes off. But there are also aerial invaders to cope with.

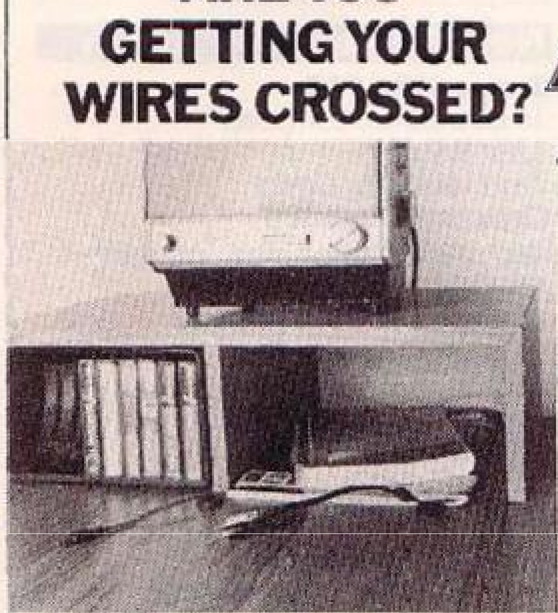
Helicopters and fighters come zooming in to blast you with their rockets. So you have two sets of controls; one for your anti-tank guns and another for anti-aircraft cannon. Both at the same time can be pretty hectic, but the program does allow you to practice on each one separately. The game is by no means original, but is implemented skilfully. ■



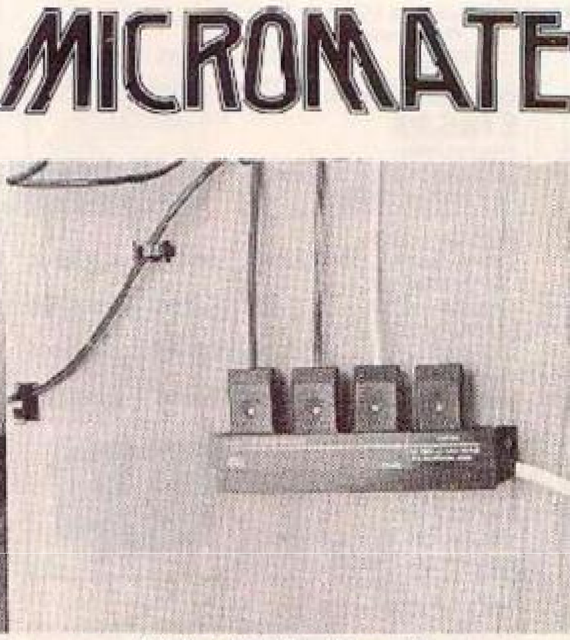
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MUSIC HARDWARE



Kendall Wrightson opens the lid on electromusic.

MAJOR ELECTRONIC MUSICAL instrument manufacturers such as Yamaha, Roland and Sequential Circuits have not been slow in incorporating the latest technology into their machines. The rate at which synthesisers, sequencers and drum machines appear is almost as staggering as the facilities they offer.

Most home computers have sound facilities. The better ones, musically speaking, like the CBM-64 can produce reasonable results if you have the patience and aptitude to write your own programs.

Dedicated synths involve a lot of clever hardware as well as software and the more professional musical home computer packages either include extra hardware such as voice cards to transform the micro into a synth, or use the micro to control a dedicated synth as we shall discover.

Synthesisers utilise many techniques to create imitative sounds. The most common method, known as subtractive synthesis, involves control of the frequency of one or more oscillators from a music keyboard, guitar or computer.

The oscillators produce wave forms of complex harmonic structure, like triangle, sawtooth and square waves. These wave forms are then modified by a sort of special tone control called a filter.

Varying the filter's cut-off frequency removes harmonics of the complex wave form — hence the term subtractive. However harmonics may also be greatly emphasised by increasing the filter's resonance or Q.

The filtered tone then enters an amplifier,

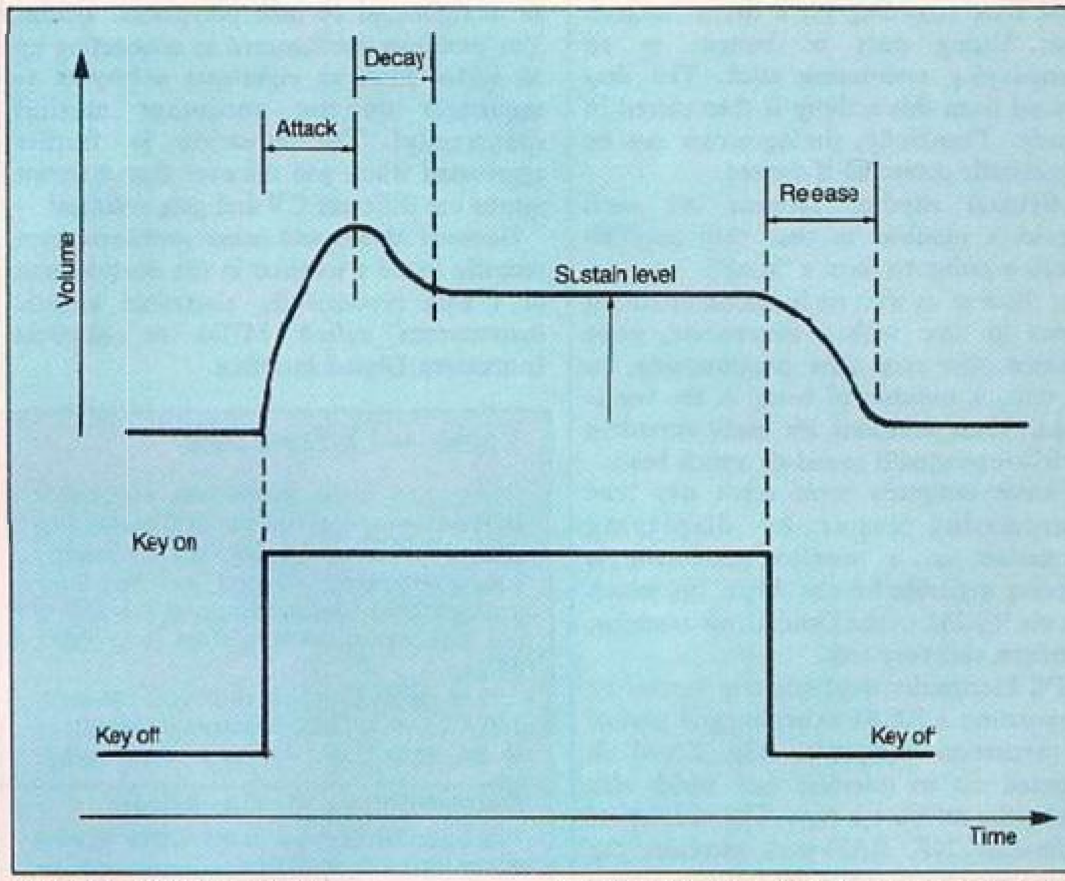


Figure 1. ADSR envelope.

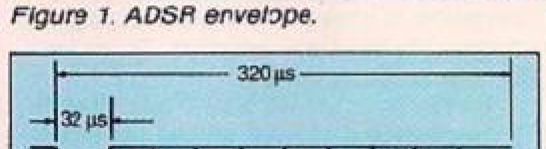


Figure 2. MIDI serial.

but will sound uninteresting to the human ear, because it is static. This is overcome by generating modulation signals which can be routed to the filter, the amplifier and the oscillators. These modulating signals may be generated by low freqency oscillators or LFO's, velocity and pressure sensors fitted to the keyboard, and by performance controls.

One special kind of modifying signal is an envelope — so called because of the way it shapes sound. The envelope's parameters, attack decay, sustain and release — ADSR — are set up by the user. When applied to the amplifier, the envelope shapes the volume of the sound applied to its input in the following way — having played a note, the attack rate controls the time taken for the sound to reach a maximum level. Decay is the time taken for the sound to reach a sustain level. The sound will remain at this sustain level until the key is released whereupon the sound will die away at a rate dependent upon the release setting — see figure 1.

A collection of control settings is called a patch. Before the advent of the microprocessor and cheap memory, a change of patch involved twiddling all the control knobs to their appropriate positions — a somewhat time consuming activity, particularly during a live performance!

These days life is made easier because patches are stored in memory and may be instantly recalled. Modern synths also allow patches to be saved to and loaded from tape.

Below: CBM-64 and Drumtrax.



(continued on next page)

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Other methods of synthesis include frequency modulation techniques or FM, additive synthesis and more recently, the sampling of real sounds. However, the terminology described above may be applied to any method of synthesis.

Simulating drum sounds electronically is extremely difficult. For this reason contemporary drum machines use samples of real drum sounds. The sounds are digitised through an analogue to digital converter — ADC — and stored in Eprom. So when you hit the trigger pad or press the button, the Eprom's contents are clocked out through a digital to analogue converter, or DAC, under microprocessor control.

Real time recording on a drum machine means hitting pads or buttons to an accompanying metronome click. The data provided from this activity is then stored in memory. Thankfully, timing errors can be automatically corrected if desired.

Individual rhythm patterns are each assigned a number so that they may be chained together to form a "song".

For those of us with no intention of hitting buttons in time with a metronome, some machines offer step time programming. In step time, a number of beats to the bar is chosen. Then decisions are made regarding which drums should sound on which beats.

A home computer could make step time programming easier by displaying information on a monitor. Software is becoming available for the Apple IIe, which links via RS-232 to the Drumulator machine, to perform this very task.

MPC Electronics went one step further by incorporating a ZX-81 as an integral part of the percussion computer. The ZX-81 is connected via an interface unit which also contains the software it runs. The addition of the Sinclair 16K RAM-pack increases the machine's memory, while the software allows the loading and saving of patterns, as well acting as a visual aid to composing.

Sequencers, like drum machines, record data with respect to time. The difference is that sequencer data represents keyboard depressions and the length of time that keys are held down, so why not make a conventional analogue recording?

Well, first, a sequencer can play back at different tempos, without affecting pitch. Secondly, the sequence may be played back using a different pitch to the one it was programmed with. Thirdly, sequencers offer the non-musician the chance to compose music through step time note entry, where pitch and timing information is entered separately.

Again, like drum machines, sequences can be chained together to form "songs". The sequence order can be changed if it is unsatisfactory.

Originally, synthesisers used to generate a control voltage or CV — proportional to the pitch played, and a gate signal — proportion to the length of time a key was held down. It was these signals, after analogue to digital conversion, that sequencers used to record. This was fine for synths which were capable of playing only one note — monophonic — since it would require only four cables to connect a synth to a sequencer for record and playback.

Modern integration developments have led us to eight and 16 note polyphonic synths. The problems encountered in connecting up 32 cables from an eight-note polysynth to sequencer do not encourage musical spontaneity! The situation is further aggravated when you discover that different synths use different CV and gate voltages!

However these, and other problems have recently found a solution in the development of a data protocol for electronic musical instruments called MIDI or Musical Instrument Digital Interface.

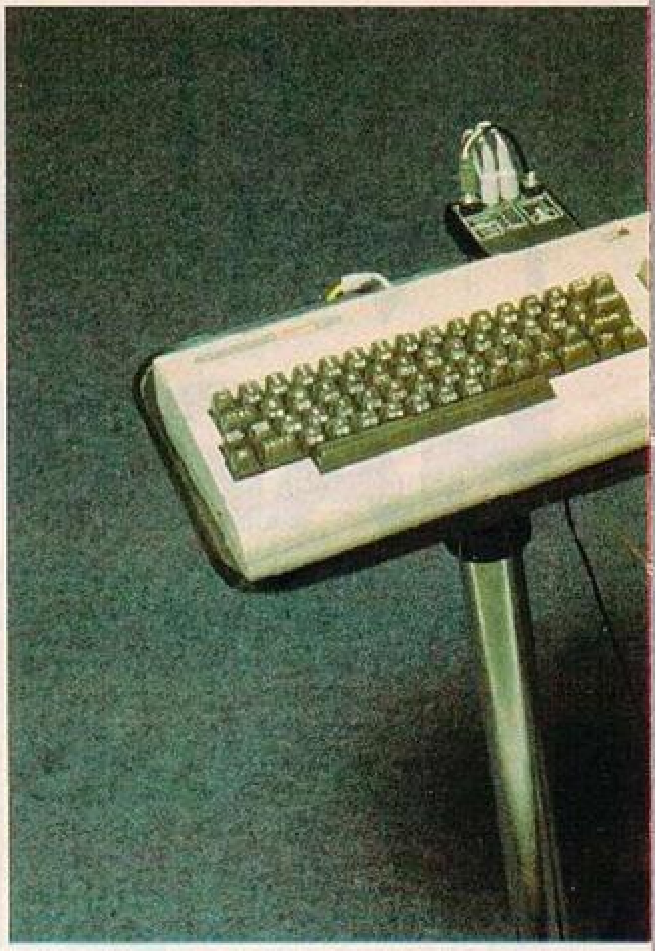
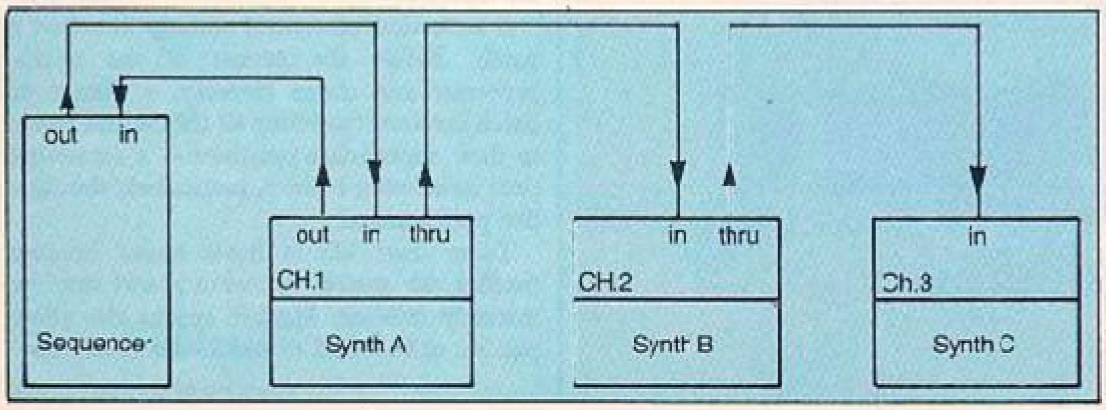


Figure 3.



Casio — ZX Spectrum

Casio has been producing electronic keyboards by the million in the last few years. Indeed a recent survey asking young people to list their favourite toys, had portable keyboards up at the top of the list along with micros and BMX bikes.

It is good to know that you can now link a Casio MT-200 portable keyboard to a ZX Spectrum — and most other popular micros — via the Casio PA1 interface. The software, listed in the MT-200 manual turns the Spectrum into a sequencer with editing facilities.

Alternatively the software is available on cassette from Micro Musical Limited, which is also working on a system called Microlink 2. This will allow the linking of two existing Casio models — the MT800 and PT-80 — to the Spectrum to provide a sequencer which can also turn the Casio auto-rhythms on and off.

Soundchaser for the Apple

The Soundchaser turns an Apple II or IIe micro into a dedicated synth, through the insertion of three cards into the Apple's magic slots. Also provided is a four octave music keyboard.

Passport Design's Four Track Performance Software makes the Apple act like an eight voice polyphonic synth. There are two soft oscillators per voice, each with independent ADSRs and one LFO which can independently frequency modulate either oscillator.

Because the oscillators are soft, you can edit existing waveforms or waves on the VDU, using a joystick or create your own. You can also build up a wave by controlling the amplitudes of a table of 16 harmonics. This is additive synthesis mentioned earlier.

All waves displayed may be printed, as can voice parameters.

The Soundchaser also provides a filter, and although you cannot control it dynamically with the ADSR envelopes, its possible to type in the cut off frequency then see as well as hear the result. It is this combination of both additive and subtractive synthesis which makes the Soundchaser produce such a wide variety of sounds.

Also included in the software is a four track real time polyphonic sequencer, although step time editing software is available. The sequencer allows four different patches to play up to eight notes simultaneously. All voice and sequencer information can be stored on disc as wave or track files.

The Hardware and Four Track Performance Software combs to £1,369, which may seem a lot, but comparable dedicated systems cost between £3,000 and £8,000.

PDSG for the BBC

A similar system to the Soundchaser is being developed for the BBC Micro by Clef Products. The Programmable Digital Sound Generator or PDSG, allows 8-32 note polyphony from a five-octave music keyboard which is included in the provisional retail price of £400. Software being developed includes waveform creation and sequencing. It will be interesting to see how the PDSG compares to the Soundchaser when it is formally launched.



Above: CBM-64 and Sixtracks.

MIDI is a new word to add to your vocabulary of computer-speak. It came about, like MSX, out of a need to standardise a very non-standard world. Things begin to get very exciting when synths, drum machines and sequencers operate together as an integrated unit. However, before MIDI was agreed by the major synth manufacturers, it was difficult to get excited about such things due to the inherent non-compatability of products. Each drum machine had its own way of telling the outside world it had started, then there's the sequencer problem mentioned earlier.

MIDI cures such problems, as well as allowing the transfer of much more specific messages.

Physically, MIDI appears as two or three 5-pin 180 deg. DIN sockets on a synth, drum machine or sequencer — MIDI In, Out and Through. The MIDI Through socket outputs a direct copy of data entering the MIDI In socket. A manufacturer does not have to fit a MIDI Through facility. Only two of the five DIN pins are used, so MIDI transmits and receives data serially.

This particular facet of MIDI was heavily debated because it was felt by some manufacturers that a serial link would be too slow. In practice there have been complaints of noticeable delays when transmitting keyboard data to more than three synths at once. However, the convenience of using single 5-pin DIN leads rather than multicore cables must have tipped the balance for the supporters of serial transmission.

MIDI runs at 31.25 Kbaud asynchronous. The word format is shown in figure 2. So, to MIDI-fy your micro, wire up an asynchronous communications interface adaptor or ACIA, like the Motorola 6850 to the expansion orifice of your micro. Address the ACIA nicely and tell it to transmit and receive as in figure 2, i.e., one stop bit, one start bit and no parity.

Wire the ACIA transmit output and input to appropriate 5-pin DIN sockets.

Don't forget to opto-isolate the MIDI In input otherwise nasty earth loops could develop. Now write some brilliant software and make lots of money! Seriously though, for anyone considering designing their own interface, the MIDI hard and software specification is available from the MIDI Users Group, 8426 Vine Valley D.R. Sun Valley, CA91352, U.S.A.

The MIDI data format is divided into two categories — channel commands and system commands. The channel command format allows for 16 unique channels for communication between instruments.

One of the most fundamental tasks MIDI must allow is for one synthesiser to play another. The channel command structure gives three ways or modes of performing this task.

In omni mode, all synthesisers connected together will transmit and receive on all channels. In poly mode each synth is set by the user to receive on only one channel. The synth will therefore ignore any incoming data which is not on its assigned channel. Figure 3 shows a typical poly mode set up. Note that Synth A. is used as the MIDI transmitter.

Mono, the third possible mode, allows the allocation of different MIDI channels to individual voices within one synth. This opens up the exciting opportunity of one synth playing different patches on each voice. However, at the time of writing, the only reasonably priced synth capable of mono mode operation is the Sixtracks made by Sequential Circuits.

Let's take a meaningful example — suppose a middle C is played on a synth. In the MIDI scheme of things this is called a note on event. Three bytes will be transmitted from the synth's MIDI Out socket to represent this:

First Byte — 1001 nnnn

Where 1001 means note on event and nnnn



is the MIDI channel number (0 to 15).

Second Byte — 0kkk kkkk

Where kkk kkkk is the key number — 0 to 127 in semitones.

Third Byte — 0vvv vvvv

Where vvv vvvv is the velocity at which the note was played (0-127 levels). So, if you delicately stroked the key, you would generate a velocity byte equal to 1. If, however, you hit the key with a large mallet, you would generate a velocity of 127 — this practise is not advised.

Synths which do not have velocity sensitive keyboards transmit a velocity byte of 64 (decimal) as a default value. So, if a middle C was played on a non-velocity sensitive synth set to MIDI channel 1, the data transmitted would be:

144,60,64. (decimal)
90,3C,40. (hex)
10010000, 00111100, 01000000 (Binary)

Other channel commands include note off event — 3 bytes — and patch change request — 2 bytes.

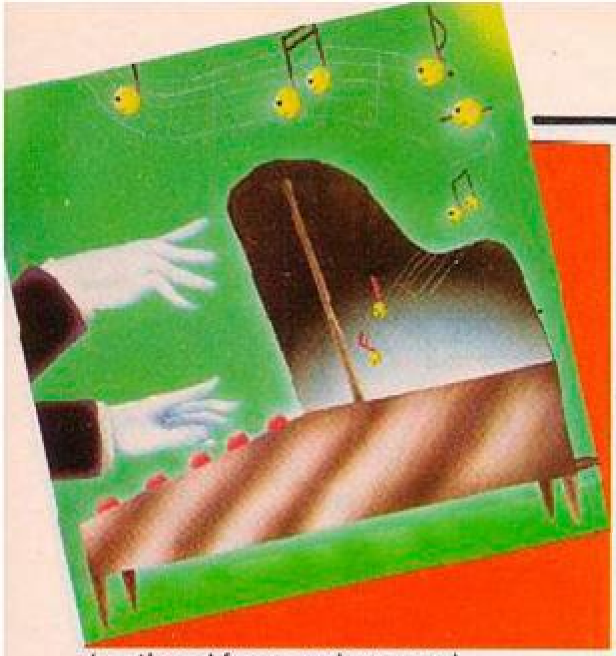
The second catagory of commands, systems commands, is divided into three types: system common; system exclusive and system real time.

System common commands are those intended for all devices in the system. An example is asking synths to tune their oscillators, a tune request — 1 byte.

System exclusive commands are those applicable between instruments of the same internal design. The system exclusive command, 240 (decimal) is therefore followed by a number representing the manufacturer —

(continued on next page)





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Sequential Circuits' number is 01.

The number of bytes which follow is dependent on the nature of the data to be transmitted. An end of system exclusive is flagged by transmitting 247. Examples of system exclusive information are patch dumps and specific control knob changes.

The third category of system commands, system real time, are those messages concerned with synchronisation. They can be transmitted at any time by sequencers or drum machines. Examples are, Start, Stop, Reset and Timing Clock. The timing clock pulses are sent at a rate of 24 clocks per quarter note. Most MIDI drum machines and sequencers have Trigger, Clock or Sync outputs like their non-MIDI counterparts so as not to alienate customers with pre-MIDI equipment.

A micro fitted with suitable MIDI interface could perform wondrous tasks as part of a MIDI set up. Here are some examples:

Sequencer.
Patch data dump to take on disc.
Patch data display.
Music transcription.
Intelligent arpeggiator.
Educational software.

The following is a survey of commercially available interfaces and software for home micros. The list is not exhaustive, the criteria being to cover as many micros as possible. Manufacturers and retailers addresses can be found at the end of the article. ■

CBM 64

Sequential Circuits, the pioneer of MIDI, has taken the CBM-64 under their wing and come up with a 4000 note real time sequencer called the Model 64.

The Model 64 allows overdubbing, auto time correction and transposition. Its six tracks can be chained together and both sequences and songs may be dumped to tape or disc. A drum machine sync input is provided, although sequences may be recorded without a drum machine connected.

Passport Designs — designer of the Soundchaser software — will shortly be launching a MIDI card for the CBM-64. The card includes MIDI In, Out and drum sync connections. The MIDI/4 software provides 16 real time tracks, each of which can be assigned its own MIDI channel and instrument name.

Apple

The MIDI/4 software can also run on an Apple II or IIe using Passport's Apple interface card. This card is also used for music transcription software called Polywriter. The software is a four note polyphonic version of the Notewriter monophonic transcriber for the Soundchaser system. Polywriter allows printouts in eight different formats, ranging from single, treble and bass clef parts, to large orchestral stores.

Spectrum

The ZX Spectrum is popular among the small entrepreneurs, like Upstream whose software consists of a six track, 3500 note real/step time sequencer. The interface, which is included in the overall price of £179, boasts a trigger output along with MIDI In, Out and Through connections. Optional extras include editing facilities and a dot and stave graphics display.

XRI Systems is asking £108 for its MicronMidi interface and software for the Spectrum. Micron is an 8,000 note real time sequencer with MIDI In, Out and Through connections as well as a trigger output. The Micron can also handle step time note entry in eight tracks, each of which can hold 3,000 notes. Tracks may then be merged or "bounced" onto on track to make space available for further recording.

Yamaha CX5

If you are considering changing your micro, then Yamaha's MSX computer, the CX5 may well be worth the wait. It is expected in November.

The CX5 is actually going to be marketed as a musical instrument as well as a home computer in this country, due to the fact that it comes fitted with MIDI interface and an FM voice module as standard.

The Yamaha CX5 is not the same as the Yamaha YIS503 MSX computer reviewed by the British computer press recently.

Having typed Call Music, the CX5 becomes an eight note polytechnic, 48 patch synth. There is also a rhythm box which unfortunately is rather weak.

The CX5 also allows 48 of your own FM synth patches which are used in the CX5's built-in real time sequencer. The CX5 is expected to retail for about £560, fair dos for its synth facilities alone.

BBC

The BBC Model B gets the MIDI treatment from Electro-Music Research (EMR). Its Miditrack software is step time only onto six tracks, however dynamics can be programmed. The interface which connects to the Beeb's 1MHz Bus, provides MIDI In, Out and drum machine synchronisation facilities. The interface and software is expected to go for about £120.

CONCLUSIONS

■ MIDI, though still very young, has definitely caught the imagination of both manufacturers and public. Its now almost impossible to sell any electronic musical instrument that doesn't feature MIDI in its specification.

■ Both the Soundchaser and PDSG systems are likely to incorporate MIDI shortly.

■ At present, the cheapest polyphonic synthesisir with MIDI is about £650; the cheapest MIDI drum machine is £950. So, assuming you use a MIDI home micro as the sequencer, a professional set up is going to cost about £1,750. However, the prices of synths and drum machines has been falling sharply over the past five years and this is a trend that is sure to continue.

■ Its clear that there are plenty of ways of getting extremely musical with your micro, even if your micro has not expressed a musical bent in the past. Why not take the plunge? It could prove to be a very rewarding experience.

USEFUL ADDRESSES

M.P.C. Percussion Computer:
M.P.C. Electronics,
The Gables,
Willingham,
Cambridgeshire.
Tel. (0954) 60264

Upstream MIDI Interface:
Upstream Computer Systems Ltd.
49, Bransgrove Road,
Edgeware,
Middlesex.
Tel. 01-952-9105

Soundchaser, Drumulator, Model 64 Sequencer, Sixtracks, DX series synths, CX5 Computer, Passport Designs Software:
Syco Systems Ltd.
20, Conduit Place,
London W2.
Tel. 01-724-2451

Micron MIDI:
X.R.I. Systems,
10, Sunnybank Road,
Sutton Coalfield,
West Midlands.
Tel. 021-382-6048

PDSG:
Cleff Products (Electronic) Ltd.
44a, Bramhall Lane South,
Bramhall,
Stockport,
Cheshire.
Tel. 061-439-3297

BBC "MIDITRACK" Software and Interface:
Electro-Music Research,
14, Mount Close,
Wickford,
Essex.
Tel. 03744 67221

Casio MT-200 Interface: and Microlink-2,
Micro Musical,
37, Wood Lane,
Shilton,
Coventry.
Tel. 0203 616760

THIS SOFTWARE AND hardware combination stemmed from a desire to create good music without the need for talent. At first a series of short sequencing programs emerged. Soon I realised that music sounded much better played by hand and this was the result.

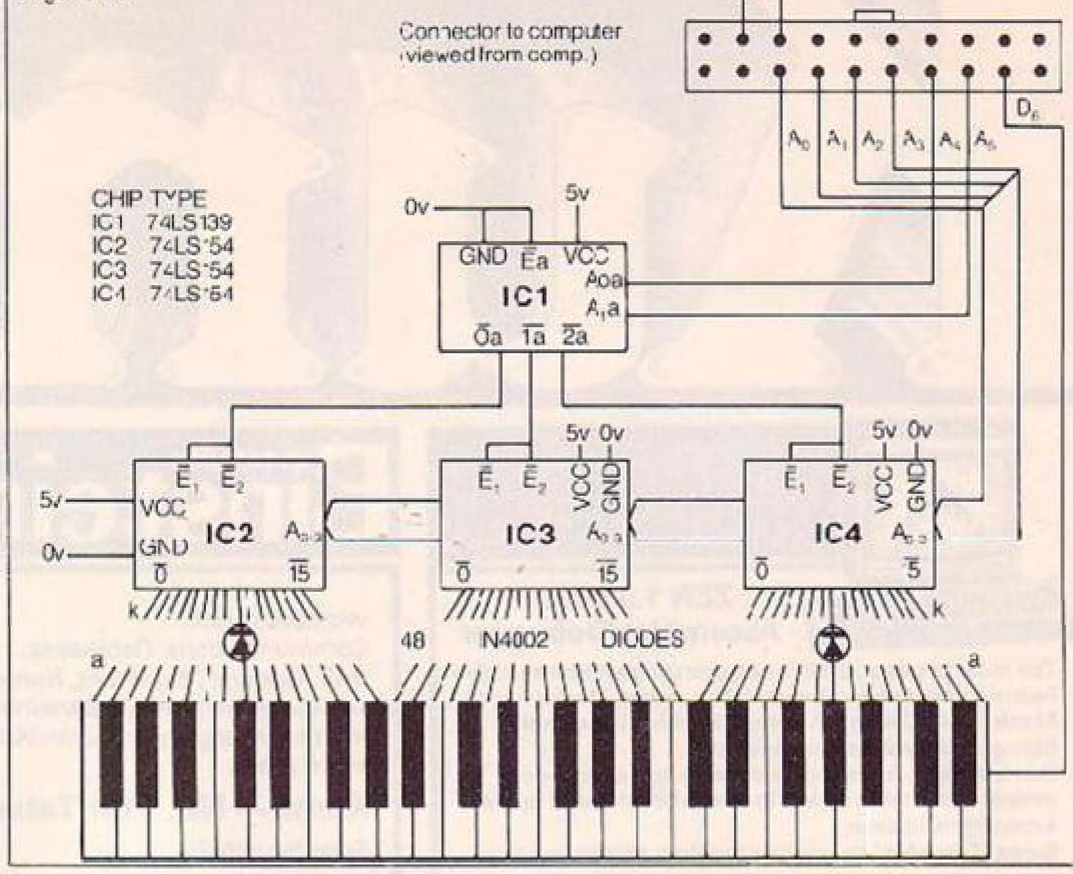
There are two programs outlined one of which uses a specially made keyboard costing under £50 to build and the other which uses the much inferior computer's keyboard.

The circuit diagram for the keyboard is shown in figure 1. All the connections to the BBC microcomputer are made through the user port. Six bits of data are output by the computer, two of which select one of three banks of 16 keys using a 74LS139 demultiplexer. The outputs from the 74LS139 go to the enable inputs of the three 74LS154, 1 of 16 decoder/demultiplexers.

The enabled one of these then uses the other four bits to make one of the 48 keyboard lines go low. If this key is pressed, the low signal is passed on to the output line from the keyboard which is normally kept high by the 1K resistor. This signal is then read by the computer to see if the key is pressed. In effect, the computer sends a key number to six bits of the port and then reads the seventh to see if the key is pressed.

The easiest way to build the main circuit board, which consists of the four chips and the 1K resistor, is to use the Verowiring system. Using this system the chips can be placed in the specially made boards and simply wired up using the pen and soldering

Figure 1.



KEYBOARD FOR

Figure 4.

```
*   10 DIMP 300
    20 DIMF 50
    30 FLAGS=F
*   40 FORI=0TO7
    50   READ A
    60   P?I=A
    70   NEXT
*   80 STBL=P
*   90 ST=P+8
   100 OSBYTE=&FFF4
   110 OSWORD=&FFF1
   120 FORI=0TO2STEP2
   130   P%=ST
   140   [OPTI
   150   .START LDX #0
   160   STX &70
   170   LDX #17
   180   STX &71
   190   INX
   200   STX &72
   210   INX
   220   STX &73
   230   .LOOP LDX #0
   240   LDY #0
   250   LDA #129
   260   JSR OSBYTE
   270   CPY #&1B
   280   BNE NTESC
   290   LDA #126
   300   JSR OSBYTE
   310   RTS
   320   .NTESC LDX &70
*  330   STX &FE60
*  340   LDA &FE60
*  350   AND #&40
   360   BNE NPRSD
   370   LDX &70
   380   LDA #0
   390   CMP FLAGS,X
   400   BNE NKEY
   410   LDA &73
   420   ORA #64
   430   LDX &72
   440   STX &73
   450   LDX &71
   460   STX &72
   470   STA &71
   480   AND #31
   490   LDX #48
   500   .LOOPA CMP FLAGS-1,X
   510   BNE NTHIS
   520   TAY
   530   LDA #1
   540   STA FLAGS-1,X
   550   TYA
   560   .NTHIS DEX
   570   BNE LOOPA
   580   LDX &70
   590   STA FLAGS,X
   600   STA STBL
   610   LDA #1
   620   STA STBL+2
   630   .D1 LDA #10
   640   STA STBL+6
   650   JSR SND
   660   .NKEY LDX &70
   670   INX
*  680   CPX #48
   690   BNE STORE
   700   LDX #0
   710   .STORE STX &70
   720   JMP LOOP
   730   .NPRSD LDX &70
   740   LDA FLAGS,X
   750   TAY
   760   LDA #0
   770   STA FLAGS,X
   780   TYA
   790   CMP #2
   800   BCC NKEY
   810   ORA #64
   820   CMP &71
   830   BNE J1
   840   LDX &72
   850   STX &71
   860   LDX &73
   870   STX &72
   880   LDX #0
   890   STX &73
   900   JMP J2
   910   .J1 CMP &72
   920   BNE J3
   930   LDX &73
   940   STX &72
   950   LDX #0
   960   STX &73
   970   JMP J2
   980   .J3 LDX #0
   990   STX &73
  1000   .J2 LDX #63
  1010   AND #31
  1020   CPX &72
  1030   BCS J4
  1040   STA &73
  1050   JMP CLSE
  1060   .J4 CPX &71
  1070   BCS J5
  1080   LDY &72
  1090   STY &73
  1100   STA &72
  1110   JMP CLSE
  1120   .J5 LDY &72
  1130   STY &73
  1140   LDY &71
  1150   STY &72
  1160   STA &71
  1170   .CLSE LDX #0
  1180   CPX D2+1
  1190   BEQ NKEY
  1200   STA STBL
  1210   LDA #2
  1220   STA STBL+2
  1230   .D2 LDA #1
  1240   STA STBL+6
  1250   JSR SND
  1260   JMP NKEY
  1270   .SND LDA &70
  1280   STA STBL+4
  1290   CLC
  1300   ROL STBL+4
  1310   CLC
  1320   ROL STBL+4
* 1330   LDA #25
  1340   CLC
  1350   ADC STBL+4
  1360   STA STBL+4
  1370   LDA #7
  1380   LDX #STBL MOD 256
  1390   LDY #STBL DIV 256
  1400   JSR OSWORD
  1410   RTS
  1420   ]
  1430   NEXT
  1440 ONERRORGOTO1820
```

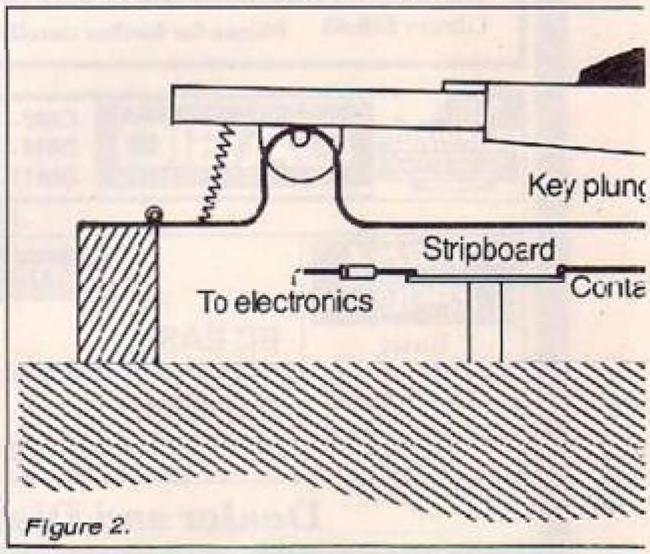
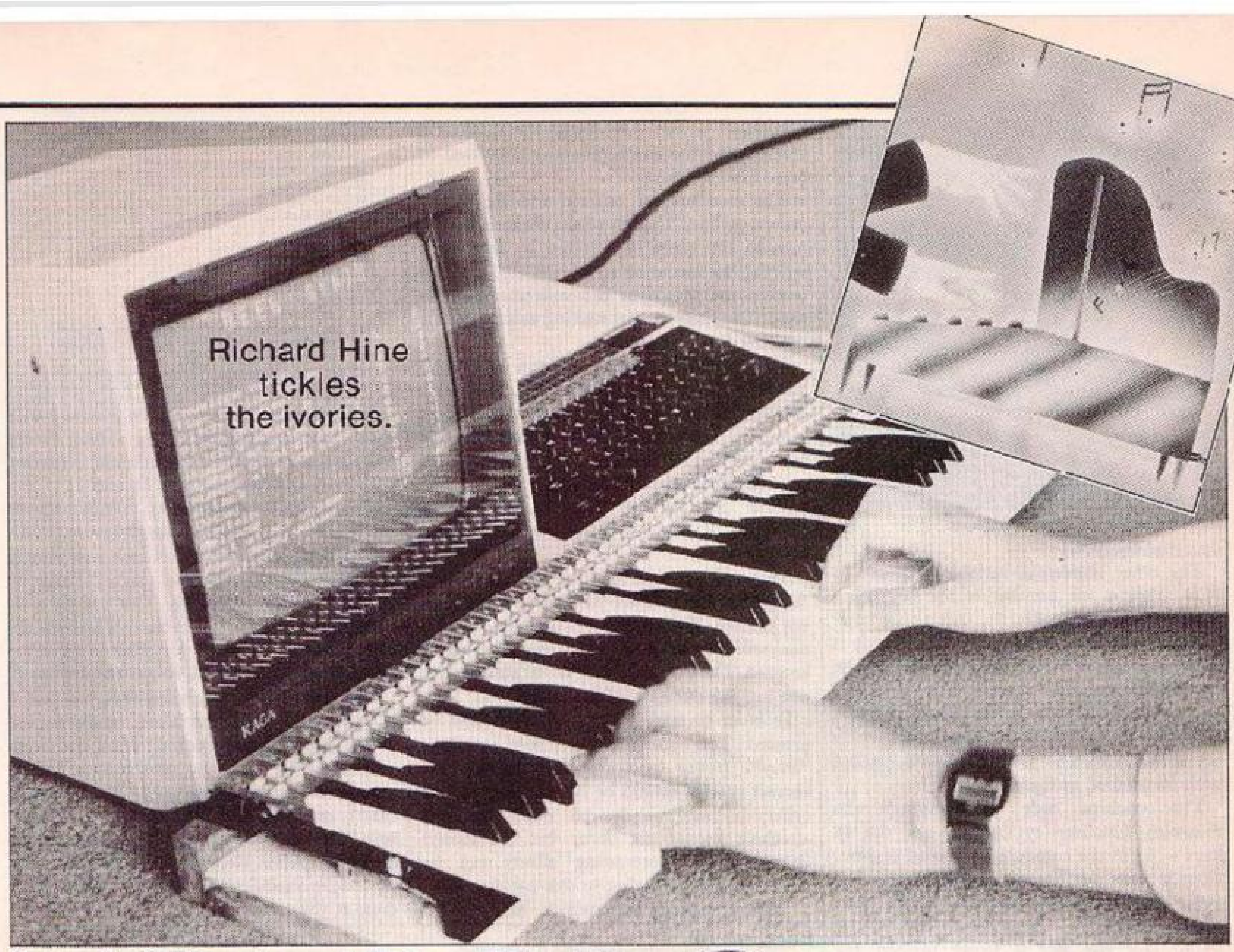


Figure 2.

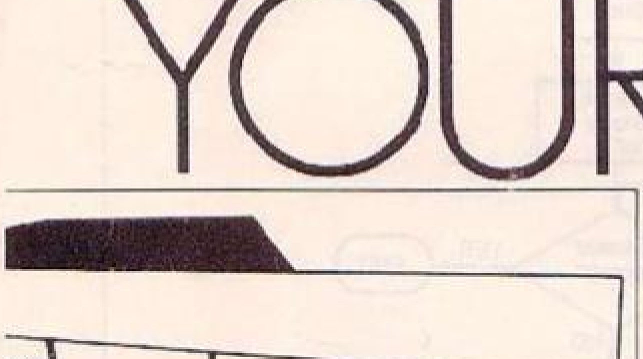
```
[illegible]
```

(continued on opposite page)



Richard Hine tickles the ivories.

YOUR BBC



iron. More thorough instructions for use are supplied with the pen.

The construction of the keyboard contacts is probably the most difficult part. Figure 2 shows how I finally decided to make the contacts. This consists of attaching silver plated springs to a series of lengths of circuit board held up from the base board by 15mm spacers. The diodes then hang from the other side of the circuit board.

Note which way round the diodes are placed, with the band away from the springs. I recommend the use of 1N4002's but almost any diode or transistor from the bit box can be used. The springs contact a gold-clad phosphor-bronze bus bar which is held up by being soldered to a number of nails. These must be carefully placed so as not to correspond to contact points.

All this gold and silver may seem very expensive but for a reliable contact it is needed. Everything mentioned above including the 48 note F to E keyboard mechanics themselves can be purchased from Maplin Electronic Supplies Ltd, PO Box 3, Rayleigh, Essex, SS6 8LR.

The main aim of the program is to allow the keyboard to be played like any other musical instrument. Certain limits are imposed such as three note polyphonics because of the limited number of sound channels. Because of the limits of the system a very strict priority order has to be followed.

Another important point is that the previous status of a key must be known, as response is only needed when a key is pressed or released. The system used here is to initiate a sound without decay when a key is depressed, and then initiate a decay envelope when the key is released.

The table which keeps a track of the previous status of the keys is called Flags and uses the following codes

0 = Key Released
1 = Key Pressed But Not Playing
17 = Key Pressed and Playing in Sound Channel 1
18 = Key Pressed and Playing in Sound Channel 2
19 = Key Pressed and Playing in Sound Channel 3

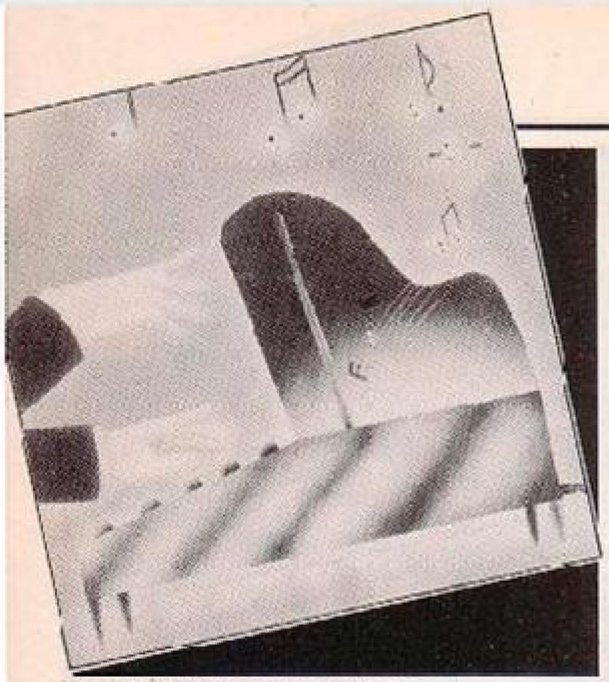
A table stored at locations 71H, 72H and 73H shows the sound channel priorities, 73H storing the lowest priority channel and 71H the highest. The codes here are best described in terms of bits. The first five low order bits represent the sound channel as above i.e., 17 or 10001 represents sound channel 1 etc., Bit 6 then shows whether the sound is playing or

(continued on next page)

(continued from opposite page)

```
1810 ON Z GOTO1640,1690
1820 FORI=1TO2
1830   ENVELOPEI,E(I,1),E(I,2),E(I,3),E(I,4),E(I,5),E(I,6),E(I,7),E(I,8),E(I,9)
,E(I,10),E(I,11),E(I,12),E(I,13)
1840   NEXT
1850 ?(DE+1)=E(1,14):?(DE+1)=E(2,14)
1860 PROCmb(18,23,131,"      PLAY      ")
1870 VDU23,1,0;0;0;0;
1880 ?&FEA2=&3F:CALL START
1890 PROCmb(18,23,129,"DEFINE ENVELOPES")
1900 VDU23,1,1;0;0;0;
1910 GOTO1640
1920 DATA19,0,1,0,20,0,1,0
1930 DATA Envelope number,Time period length,Pitch gradient 1,Pitch gradient 2,
Pitch gradient 3,Number of pitch steps 1,Number of pitch steps 2,Number of pitch
 steps 3,Attack,Decay,Sustain,Release,Peak attack volume,Post decay volume
1940 DATA Duration
1950 DATA1,0,0,0,0,0,0,0,20,0,0,0,126,126,10
1960 DATA2,0,0,0,0,0,0,0,-1,-1,-1,-1,90,64,1
1970 DEFPROCmb(X,Y,C,A$)
1980 PRINTTAB(X,Y)CHR$(C)CHR$(C)A$
1990 PRINTTAB(X,Y+1)CHR$(141)CHR$(C)A$
2000 ENDPROC
```

Fig. 4. The software for use with the music keyboard.
(* denotes difference on computer keyboard version.)



(continued from previous page)

decaying/decayed.

The other important variable is stored at 70H. This is the number of the key being processed from 0 to 47.

The block diagram for the machine code is shown in figure 3 and the program for the music keyboard is in figure 4. For those who do not wish to build the keyboard, figure 5 shows the alternative lines. Those lines which occur in figure 5 as alternatives are marked with an asterisk in figure 4.

The machine code goes through the following functions cycling through the 48 keys — 41 in the computer keyboard version. First it tests the Escape key and returns to Basic if it is pressed — lines 230 to 360. Next the key is tested — lines 320 to 360. If it is found that the key is being pressed the program looks in the table to see if it was pressed when last scanned — lines 370 to 400.

If it was, then the program goes on to the next key. If it was not, a sound must be initiated. The lowest priority sound channel is read from 73H and the other two moved down. The one just removed is then marked as sounding and placed in the highest priority position. Lines 410 to 470 do this.

The flags table is then searched for the key corresponding to the previous sound on this channel, if there was one. This key is then marked as pressed but not sounding — lines 480 to 570. The new key allocation is then marked — lines 580 and 590 — and the sound started — lines 600 to 650. The next key is then scanned — lines 660 to 720.

If the key scanned is not being pressed the table is tested to see if it was sounding when it was last scanned — lines 730 to 800. If it was not sounding, the next key is scanned. If this key was sounding, then the sound channel used is found in the priority table and the rest moved up — lines 810 to 990. This is then marked as decaying and stored in the highest priority non-sounding position — lines 1000 to 1150.

Finally the decaying sound is produced — if its duration is not 0 — and the next key scanned — lines 1170 to 1260. It should be noted that in line 1180 the program actually inspects itself! This is because line 1850 sets the durations of the sounds by altering the constants in the program.

The Basic program is used to provide an easy way of defining the two envelopes. Lines 10 to 110 initialise the various arrays and constants. Lines 120 to 1430 assemble the machine code after which the key table is initialised — line 450. Next the display is created and the envelope array initialised in lines 1460 to 1620.

The numbers are entered and the cursor moved by lines 1630 to 1810. When Escape is pressed the error is detected by line 1440 sending the execution to line 1820. This then sets up the envelopes and calls the machine code. The final section starting at line 1920 is the data for the program.

The program is designed to run in Mode 7 but will run in any. When Run, it gives a display of a column of names and two of numbers. Underneath these it says "Define envelopes". In this mode the cursor keys are used to choose the number to be altered. The number can then be typed in and entered either by moving the cursor or by pressing Return.

Note that if play mode is entered before doing this the number will be displayed but not entered. If the number is too large, the old one will be restored when the number is entered. The last parameter is not an envelope one but the duration of the sound.

In order to start playing, Escape must be pressed. The bottom of the screen now says "Play". If the keys are then pressed the correct sounds should be heard. Note that in order to hear the desired effect the first envelope should not decay but the second should. Other interesting effects can be created by not achering to this pattern.

That irritating hiss which many BBC computers seem to have can be removed with ease. This is done by fitting a plug to the 1MHz bus under the computer and soldering a 1k0 resistor between pins 16 and 1.

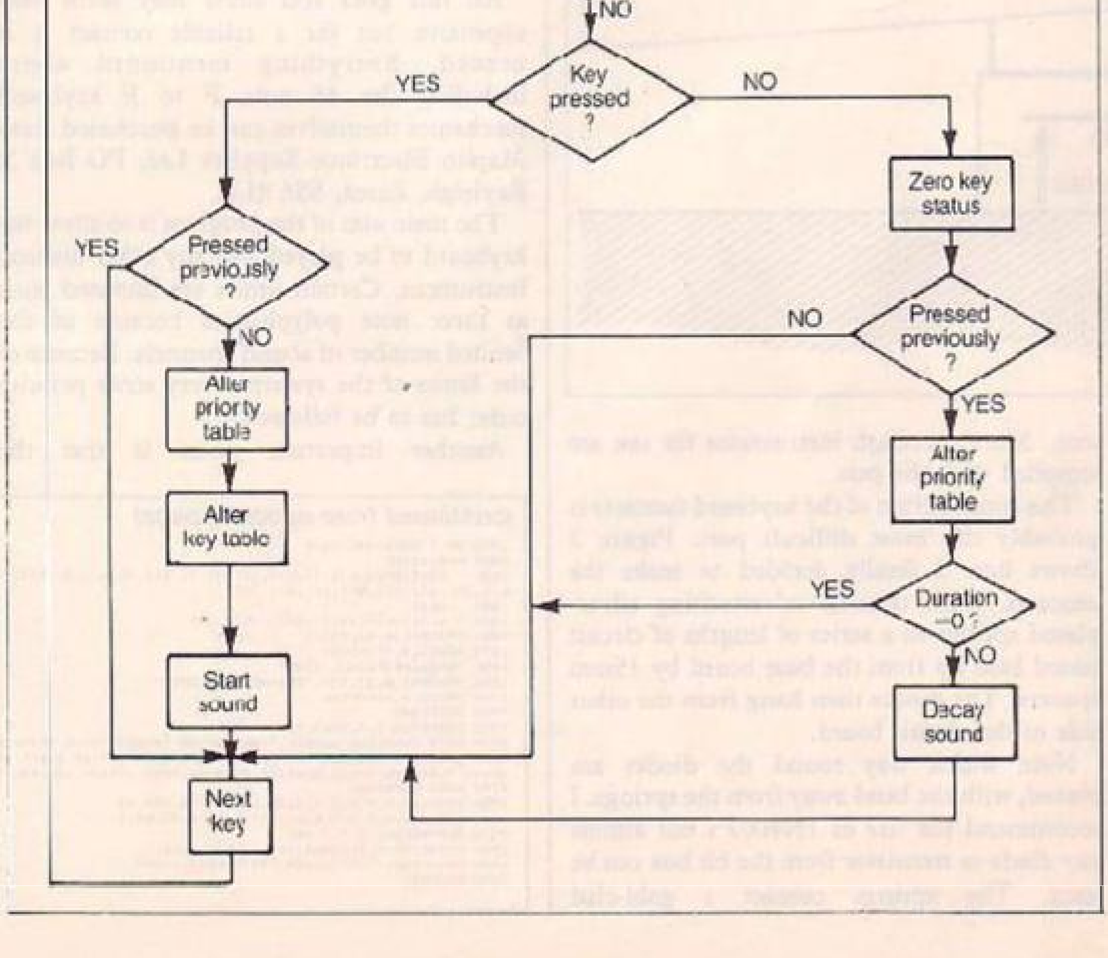
The second improvement which can be made is to use external amplification. This can be done by placing a 1/4 inch jack plug in the normally unused hole marked Reset on the back of the computer. This can then be connected via screened cable to PL16 on the circuit board. To find this, first remove the cover from the case and unbolt the keyboard.

There is no need to unplug this, just fold it away over the rest of the board. On the far left of the circuit board, looking from the front, very close to the side, and hidden in the middle of some components are two pads clearly marked PL16. The output from this is low level and can be used to supply a high quality amplifier. Please note that connection of devices, or modifications to your computer are done at your own risk.

Figure 5.

```
  10 DIMP 350
  40 FORI=0TO48
  80 STEL=P+41
  90 ST=P+49
 325 LDA P,X
 330 TAX
 335 LDY #&FF
 340 LDA #129
 345 JSR OSBYTE
 350 CPY #&FF
 680 CPX #41
1530 LDA #5
1912 DATA&9E,&AE,&BD,&CD,&AD,&9C,&AC,&7B
1914 DATA&AB,&AA,&BA,&9A,&99,&A9,&58,&A8
1916 DATA&97,&FF,&CF,&EF,&CE,&DE,&EE,&3D
1918 DATA&CC,&EC,&DC,&CB,&DB,&CA,&EA,&3A
1919 DATA&C9,&C9,&DB,&CB,&BE,&E7,&C7,&37,&D7
```

Figure 3. Machine-code block diagram.



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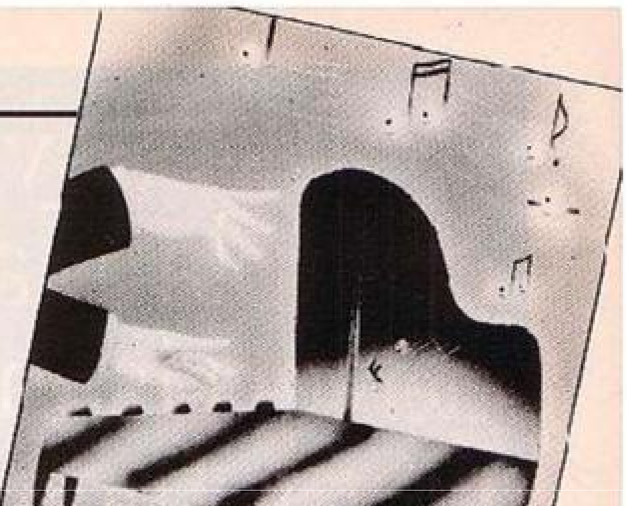
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Two Tribes — music and micros: Meirion Jones talks to the man who mixes them for Frankie.

HOW FRANKIE GETS TO HOLLYWOOD





Frankie's engineer Steve Lipson relaxes.

WITH FRANKIE GOES TO HOLLYWOOD'S new album due out in weeks Steve Lipson stares across a mixing desk into the void of a recording studio trying to improve on the great sounds he engineered for Relax and Two Tribes/War.

At the console he strikes a pose worthy of Captain Kirk at the controls of the USS Enterprise but Steve is under no illusions that he is a man with a mission. "I don't want to be Mother Theresa", he says. "I am the person who is employed to help defraud the public — and rightly so — because if the public honestly believe what they see they deserve to be defrauded.

"Frankie are nothing out of the ordinary. I've read articles which say they don't play on their records. This is a slight twist of the truth. In fact they play on their records then we make what they do better which is a perfectly logical thing to do. They're 20 years old — we're much older — we've had experience of making records and can make what they do sound a hundred times better. The artist becomes a performer. He's the guy who fronts the whole thing which is how it should be. If you have a tremendously good group to start with you limit the amount of input your production side can put in."

Steve's fraud factory is Sarm Studios in London. Outside it looks like the shabby derelict warehouses you expect to find at the wrong end of the Portobello Road. The only clue to its true purpose is a couple of fans on the steps in long black and white Relax T-shirts. They look like a pair of lost zebras as they wait for a glimpse of their heroes.

Inside, Steve Lipson is busy at the controls of his Sinclavier computer. Apart from the usual Qwerty keyboard and TV screen this has a 20 Megabyte hard disc storage unit — that's 500 times the capacity of a Commodore 64 — and a piano keyboard. Steve uses the Sinclavier mainly as a sampling machine. He can take any noise whether it is a bamboo cane hitting a shopping trolley or somebody hitting a snare drum and then produce a sequence of sounds based on that to create a new instrument.

Steve makes it sound very simple: "some geezer bangs a snare in the air. I get it to sound as wonderful as I can, stick it in the Sinclavier, organise it so that it's occupying as little space as possible for maximum effect and then proceed to sequence it. Then it is reverse compiled into script language." With his right hand Steve plays a bass line from Relax on the piano keyboard while his left hand on the Qwerty throws it on to screen as script language. On screen, phrases can be edited and repeated — just like word processing with sounds.

Another stab at the keyboard shows the file catalogue for two of the tracks from the new album, Only Star in Heaven and Black Night, White Light. Steve keeps most of the 20 Megabyte memory in use most of the time, making back up copies of any material he does not need immediately so he can free space. It is reassuring to know that even with such expensive equipment things can go wrong. The cartridge machine which should make the back-up copies on to tape is malfunctioning so Steve is having to use floppy discs "and 20 Megabytes is something like 200 discs so it's hopeless."

More and better equipment solves some problems but also creates new ones. "With Relax the problem was we were using an analogue tape recorder. Now we're using a digital — big difference." But on the new album "a lot of the bass sounds we're using now are two machines synchronised together which poses a great deal of problems."

While Steve deals with the technical side producer Trevor Horn is the man with the golden ears who seems to know what the public want to hear. "I am working with the best producer around. I will be working on a track for days and days and Trevor will walk in — he's very good at looking at the overview — and he'll say, 'No this track is rubbish, start again' ... Trevor signed Frankie goes to Hollywood because he thought they were ridiculous — good singer but absolutely ridiculous. He had two attempts to recording them, both dismal failures. I got recommended to him — it's not what you know it's who you know — I started engineering and did Relax."

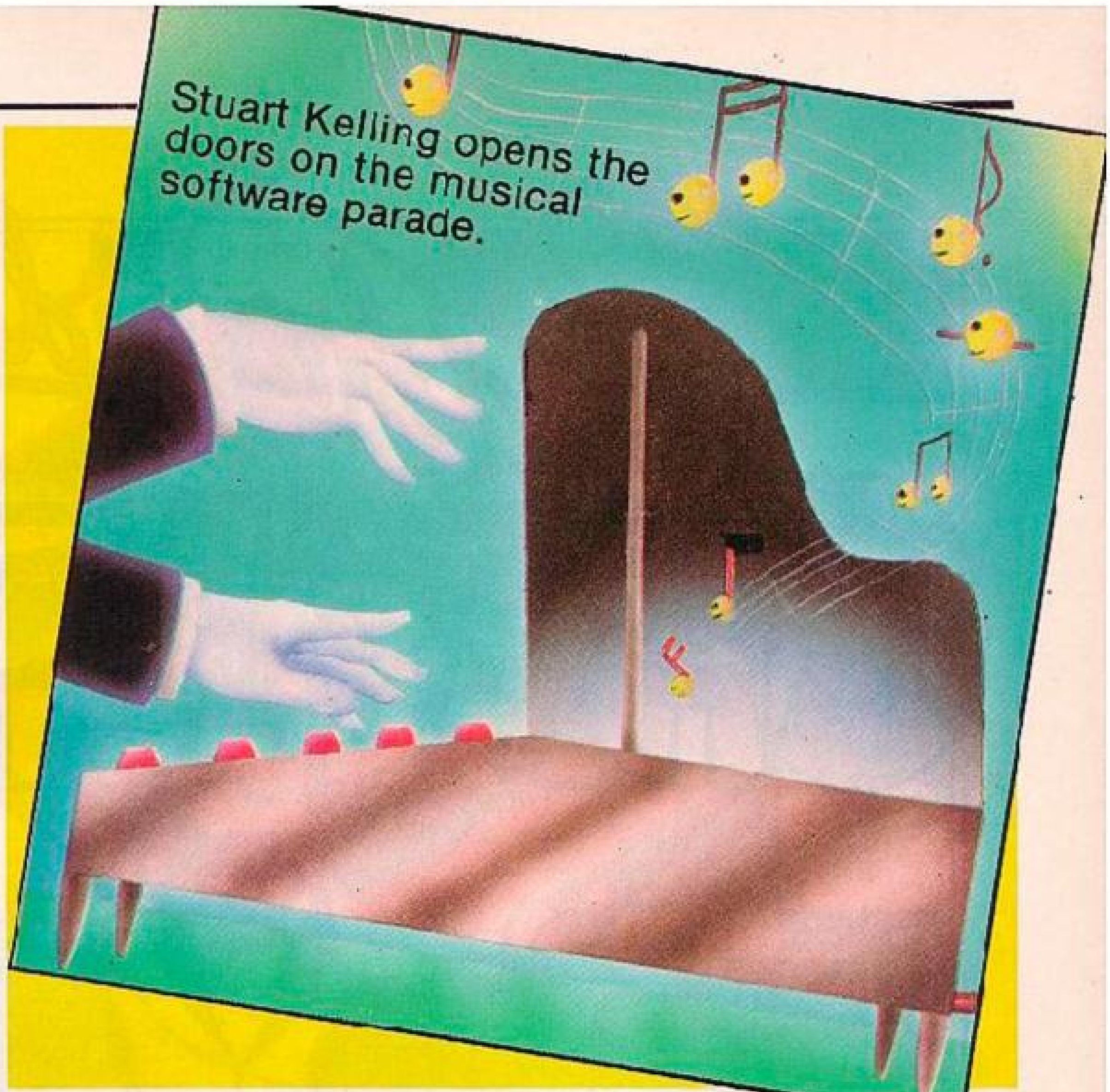
The phone rings — oh no it's Trevor — but this time he is not asking for a track to be scrapped but just for a snare drum to be taken off one of the songs on the new album and replaced with another snare drum and a tambourine. If it's a simple part Steve can do that in a matter of minutes. "If it's a complicated part it could take me four or five hours. It's easy now but the very first time I did it, it took me a whole day."

With a virtually unlimited budget for new equipment Steve can afford to dream of tomorrow's machines. "You will have an infinite track tape recorder, you will record something and then be able to move it wherever you want to." But this will require new forms of computer storage — "hard disc is so primitive".

Steve does not feel that the empires of the big recording studios are under threat from home computer-based systems using converted Commodore 64s and Midi compatible Yamaha CX-5s. "Nothing is going to happen with all that stuff. Midi's useful but going to run out shortly. There will be a Midi 2.

"8-bit sounds are unusable — the Fairlight's different because it has got a graunch noise of its own. It just lowers the quality of what we're going to be hearing. Very few people have got all the gear and then everyone else with their CX-5s and Commodore 64s will be struggling desperately hard with not really a hope in hell, apart from the odd genius." ■

MUSIC SOFTWARE



MUSIC AND COMPUTERS have been on a collision course for some time now, and the noisy impact is imminent. You only have to switch on the radio to hear computer-generated rhythms and music. A whole new language has evolved that talks of sampling and the Midi interface.

Everyone knows that Frankie Goes To Hollywood uses a digitised version of Led Zeppelin's drums, and that the modern keyboard instrument has enough computing power to run your local power station.

Soon this technology will be available in people's homes. Already microchip pianos and organs are pushing out the steam-driven versions. While that other popular piece of household furniture, the micro, is being revamped as a musical beast. The next wave of computers will be more musical than the last, but for now we will have to make do with existing technology.

Micro musicians have two options. They can take the hardware route, or the software route. Hardware involves expense and even sometimes the horrors of a soldering iron, while there are a number of interesting, yet simple software solutions available.

Music Processor

Quicksilva — BBC B

ONCE LOADED, the screen displays a parameter map which allows access to various musical functions — for example, instrument tone, volume and octave selection for each of four channels — and an optional metronome facility. These are changed using the function keys — not a difficult technique to master easily. However, with a maximum of only nine numerical values for each function, there is not a great deal of resolution, and the difference between one value and another can be extreme.

There are also drive functions — play, fast forward, and rewind — which are accessed via the cursor keys. The remainder of the screen is taken up with details of the four channels as you record and play music.

Recording is also a fairly simple affair, using the shift and keys. The counter ticks away, and off you go in real time, using the QWERTY keyboard. The Return key takes you out of the record mode, and a one-key function plays the tune back, warts and all.

Overdubbing is achieved by changing channel, key f0, which enables the original tune, as well as the overdub, to be heard. Channel 4, by the way, is reversed purely for noise for rhythm purposes. The whole procedure is quite straightforward, but as always there are drawbacks.

First, the real-time input is difficult on the QWERTY keyboard, and it is all too easy to make mistakes. Although there are editing facilities, we found it difficult to make them work. The sounds themselves are less than brilliant, but that has more to do with the limitations of the BBC B than with the software — after all, there are not many variations to a square-wave beep.

The software is well-written, and the author is obviously musically aware. With the addition of a standard keyboard and better sound chips, it could be a potent system. As it is, both the music programmer and the programming musician are likely to be disappointed.

Synth

Worm Software — BBC B

SYNTH TURNS your BBC into an organ. Page 1 gives you Play, whereby the QWERTY becomes a musical keyboard with the top part a monophonic beep, and the bottom part playing chords of the major, minor or seventh variety.

One amazing shortcoming is that you cannot play both melody and chords at the same time, which would seem to negate the provision of such a facility — unless you have multi-track recording equipment, in which case you probably would not want to use the somewhat lack-lustre BBC B tones.

Page 2 allows you to modify the envelope of the sound, and thereby its tone, but again the sounds obtained may be more suitable for a Pac-Man game than a synthesiser melody. Page 3 is a Help page, containing information on how to use the program. Were it possible to program a tune into one channel and chords into another, this might be a useful package. This failing, taken with the limited tonal range, makes this piece of software disappointing.

Multisound Synthesiser

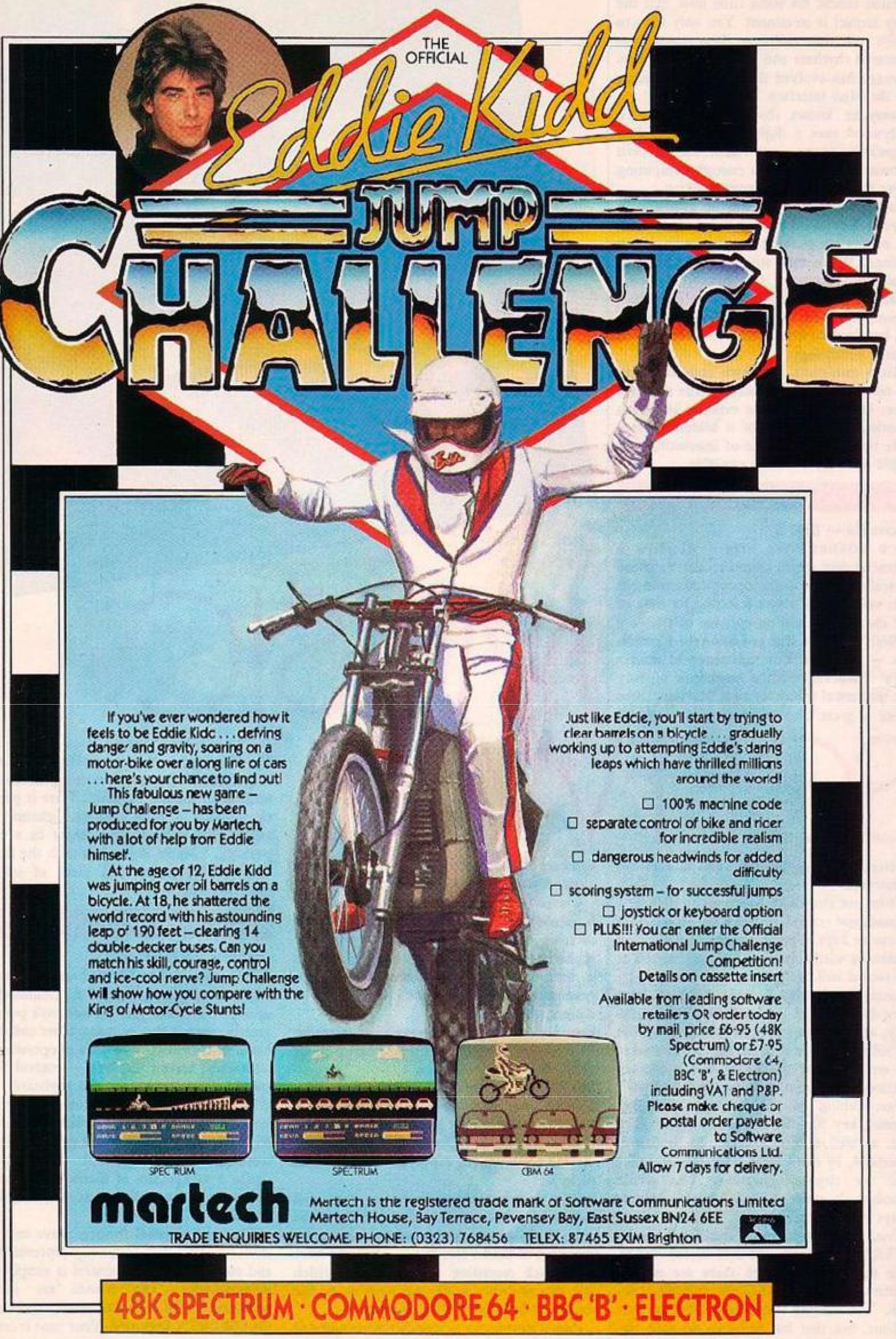
Homik — CBM-64

THIS PACKAGE is by far the best of the bunch. The flexibility and range of the Commodore's sound chips mean that the system's potential greatly exceeds that of many other computer-based instruments. The basis of operation lies with three screen displays — control panel, special effects panel, and the keyboard.

Switching from one to the other is a one-key operation, and an easy-to-follow explanation of basic sound synthesis is provided in the manual, covering the simple wave-shapes — figure 1 — and use of filters to control the harmonic content of the sound — figures 2 and 3.

The control panel features wave and filter controls, each with single-key representation, and envelope (ADSR) control is simply done incrementally. The sounds are actually produced in the keyboard mode, again using the QWERTY keyboard. Your tune is created

(continued on page 79)



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(continued from page 77)
by single-key selection, and playing in real time. You can then add more music if you wish, and you can opt for the computer's own, "auto-spaced", tempo and note length.

You will not be able to alter the speed of playback while the tune is being played, but you can choose the right tempo before recording. Playing is monophonic, with the highest note taking priority if two keys are pressed simultaneously. One useful feature is the two playback modes. Mode II, for example, enables the player to vary the playback speed by using the < and > keys. In addition, the background playing mode means that overdubbing is possible. Nine tunes may be stored in the computer's memory, but only one will play back at a time.

Operation is made easier by use of a cursor for each note played, providing a visual aid for those unsure of their touch on the keyboard. Editing is a simple task, and the multisound also has a drum mode, consisting of eight built-in patterns selected from the control panel. Any drum pattern acts as a background tune, and the rhythm sound can be altered through the ADSR selectors. You can also write your own drum routine in the same way as a background tune.

The two main factors in this package's appeal are ease of use and the sounds available. Programmers and musicians may find this a useful writing tool, as well as a source of pleasure.

Features such as oscillator and envelope sweeping, ring modulation and wave-form synchronisation controlled by the special effects panel, add greatly to the machine's sound potential, while the software is sensibly written and well explained.

Musicmaster

Incognito Software — 48K Spectrum

AGAIN, A WELL-WRITTEN package limited by the Spectrum's sound capability. A keyboard overlay is provided to simplify playing, and two modes are available. The first is Stave, giving a two-octave range of notes and matching stave screen display; the second is Keyboard, giving a 17-note playing range.

A series of reminders display length of note, rests, deletion, and so on. Bar signs are inserted automatically, indicating this system's usefulness as an educational aid.

The package is limited — for example, only one tune can be retained at any one time — but operation is very simple, and tunes, once entered, can be amended easily. Familiarity with this instrument may help your keybord literacy if you are just starting out, and may be a useful refresher for those who have forgotten their music theory.

From the point of view of a poverty-stricken musician, many of the available software packages for computer base synthesisers will be disappointing, due either to the poor sound range, or the limitations imposed by the software itself. The Commodore program is, in effect, a useful link between the standard play as you learn material, and the impending invasion of specialist packages such as Yamaha's new range.

This is not to deny that the BBC and Spectrum programs can fulfil a role — they are certainly excellent educational instruments — but it is doubtful whether they will be suitable for someone intending to use the computer as a serious writing tool.

Musicians — like everybody else — will soon be facing a bewildering choice if they intend to make use of new technology. The only advice that can really be given is to be sure of what you want before you buy it. This may seem fatuous, but there is nothing more frustrating than buying a package which turns out to be a shelf-filler and nothing else.

If you want to use the computer as a complete system, you will have to be more selective. ■



Figure 1. Saw tooth.
The sawtooth wave-form produces a tinnier sound, similar to a plucked string instrument.

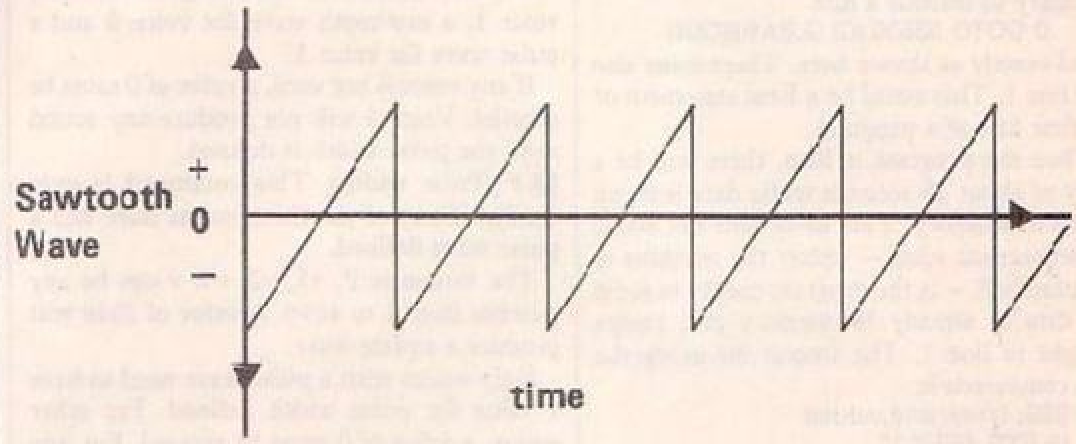


Figure 2. Low-pass filter.
The low-pass filter allows all notes below the cut-off point to pass unchanged. Notes above the cut-off point are muted at a rate of 6dB per octave.

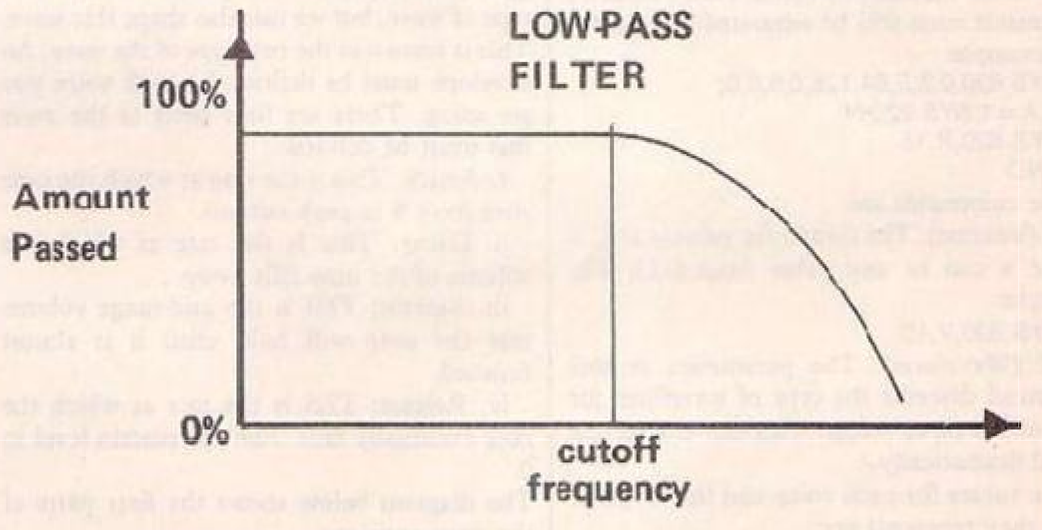
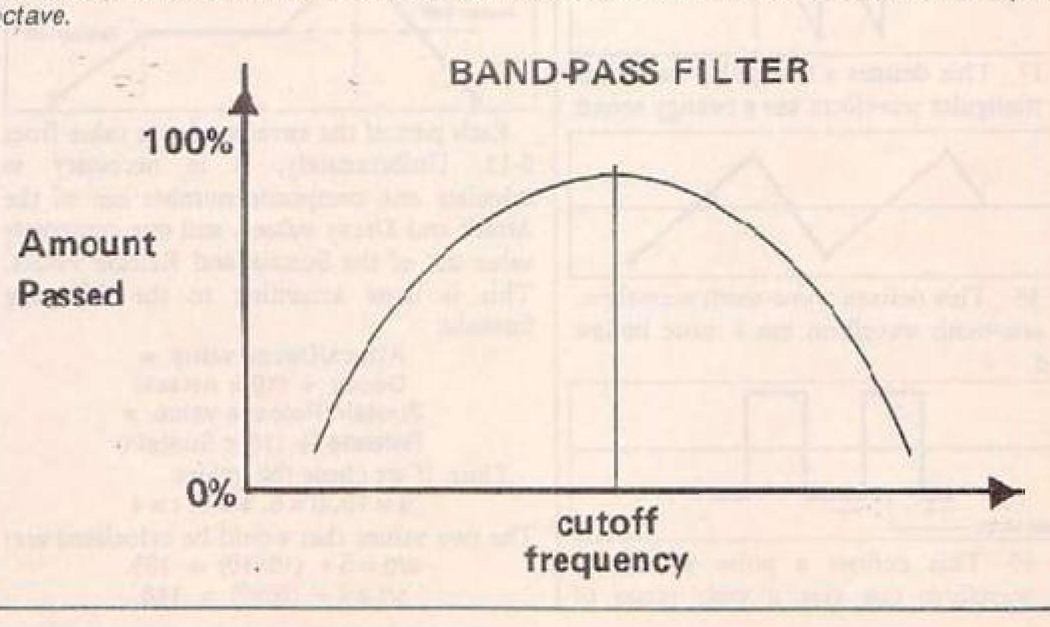
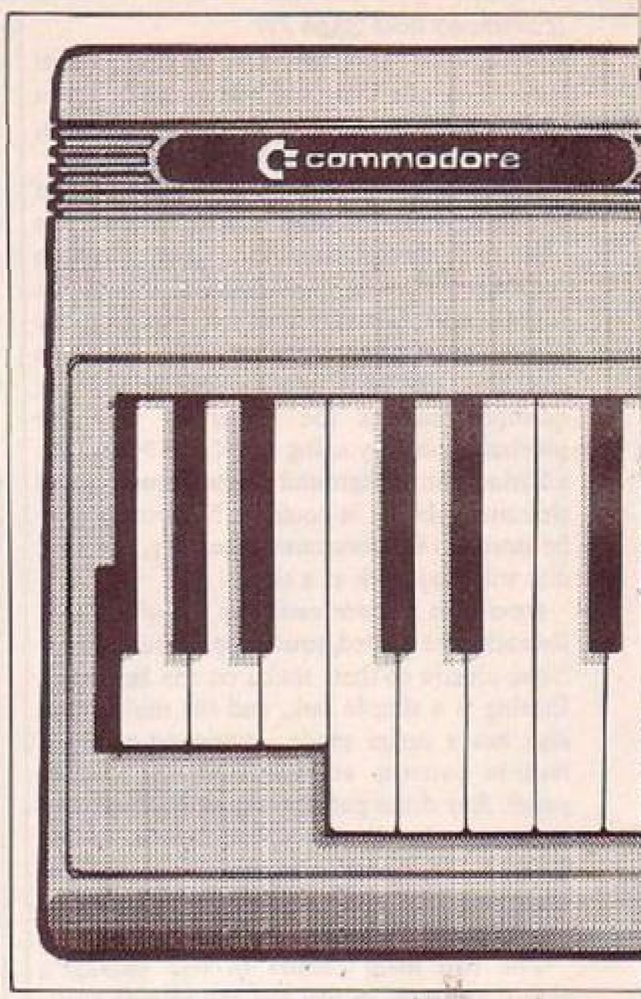


Figure 3. Band-pass filter.
The band-pass filter mutes notes both above and below the cut-off at a rate of 6dB per octave.





Graham Barbour's baker's dozen of sound commands puts some yeast in your 64



WHILE COMPILING music programs using the Commodore 64 synthesiser, I soon realised that it was sorely lacking in sound commands. It also necessitated the memorising of a large number of Poke addresses in order to be able to define the volume, wave-type, wave-shape, filters etc. For this reason I developed Musik 64 — a program which adds 13 new commands and which requires only one address — Sys 820. To use each of these new commands it is only necessary to type a single letter eg., V for volume, S for sound etc.

Musik 64 uses lines 63500 onwards, leaving lines 1-63499 free for writing any desired program. The programmer merely loads Musik 64 and can then design his program using these extra commands.

In order to get the program to run it is necessary to include a line

0 GOTO 63500:(C) G.BARBOUR

typed exactly as shown here. There must also be a line 1. This could be a Rem statement or the first line of a program.

When the program is Run, there will be a delay of about 20 seconds while data is being stored in memory. This delay will not occur on subsequent runs — unless the machine is switched off! — as the program checks to see if the data is already in memory and jumps straight to line 1. The format for using the new commands is:

SYS 820, command,values
eg., 10 SYS 820,V,15

Several different Musik 64 commands may be used in a single line using only the one Sys 820, as long as each command is separated by a *semi-colon* instead of a colon. Non Musik 64 commands must still be separated by a colon. For example:

```
10 SYS 820,0,3;E,64,128,0,0,0,0;
V,15:A = 1:SYS 820,N
20 SYS 820,R,15
30 END
```

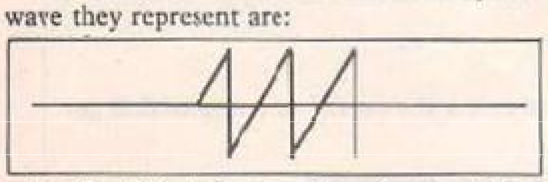
The commands are:

■ V (Volume). The format for volume is V, x where x can be any value from 0-15. For example:

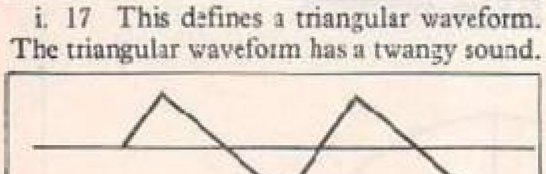
10 SYS 820,V,15

■ W (Waveform). The parameters in this command describe the type of waveform for each of the three voices. This can change the sound dramatically.

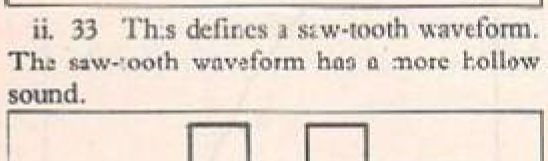
The values for each voice and the shape of wave they represent are:



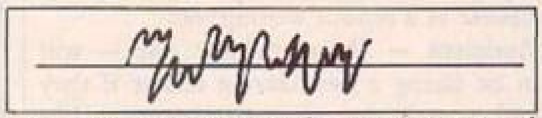
i. 17 This defines a triangular waveform. The triangular waveform has a twangy sound.



ii. 33 This defines a saw-tooth waveform. The saw-tooth waveform has a more hollow sound.



iii. 65 This defines a pulse waveform. This waveform can give a wide range of sounds, due to the fact that the width of the pulse must be defined before it will play (see next command).



iv. 129 This defines the noise waveform. This is a random wave which can be used for sound effects.

The format for this command is W, v1, v2, v3, where the v1, v2 and v3 refer to the three voices. v must be chosen from the values listed above. viz. 17, 33, 65 or 129.

Each voice may have a different value or some or all the voices can be the same. For example:

45 SYS 820, W,17,33,65

The above line defines a triangular wave for voice 1, a saw-tooth wave for voice 2 and a pulse wave for voice 3.

If any voice is not used, a value of 0 must be entered. Voice 3 will not produce any sound until the pulse width is defined.

■ P (Pulse width). This command is only needed if any of the three voices have had a pulse wave defined.

The format is P, v1, v2, v3. v can be any number from 1 to 4096. A value of 2048 will produce a square wave.

Only voices with a pulse wave need to have a value for pulse width defined. For other voices, a value of 0 must be entered. For line 45 to work, a line such as the following is necessary:

47 SYS 820,P,0,0,2000

■ E (Envelope). Not only can we define the type of wave, but we can also shape this wave. This is known as the envelope of the wave. An envelope must be defined for each voice you are using. There are four parts to the wave that must be defined.

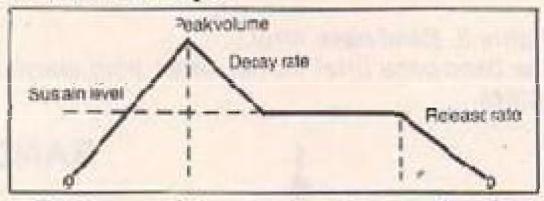
i. Attack: This is the rate at which the note rises from 0 to peak volume.

ii. Decay: This is the rate at which the volume of the note falls away.

iii. Sustain: This is the mid-range volume that the note will hold until it is almost finished.

iv. Release: This is the rate at which the note eventually falls from the sustain level to 0.

The diagram below shows the four parts of the wave envelope.



Each part of the envelope has a value from 0-15. Unfortunately, it is necessary to calculate one composite number out of the Attack and Decay values, and one composite value out of the Sustain and Release values. This is done according to the following formula:

Attack/Decay value = Decay + (16 x Attack)
Sustain/Release value = Release + (16 x Sustain)

Thus, if we chose the values:

$a = 10, d = 5, s = 9, r = 4$

The two values that would be calculated are:

$a/d = 5 + (16 \times 10) = 165.$
$s/r = 4 + (16 \times 9) = 148.$

The format is:

E, ad1, sr1, ad2, sr2, ad3, sr3.
e.g. 40 SYS 820, E, 64, 128, 5, 10, 50, 200.

■ S (Sound). This command allows you to play a note or a chord for a specific duration, after which the sound is turned off. This ability to define a duration is sorely needed on the 64. This new command replaces the numerous For commands formerly required. The format is:

S,n1,n2,n3,d

The value for n can be from 0-65536 and can be found in the note table in the Programmer's Reference Guide. The value must be taken from the table marked "Decimals".

If you only have the 64 Manual, these values must be calculated using the formula:

n = (Hi freq. x 256) + Lo freq.

The values for Hi and Lo freq. are found on page 152 of the manual.

If you do not want a sound from a particular voice, a value of 0 must be defined for that voice — this represents a rest.

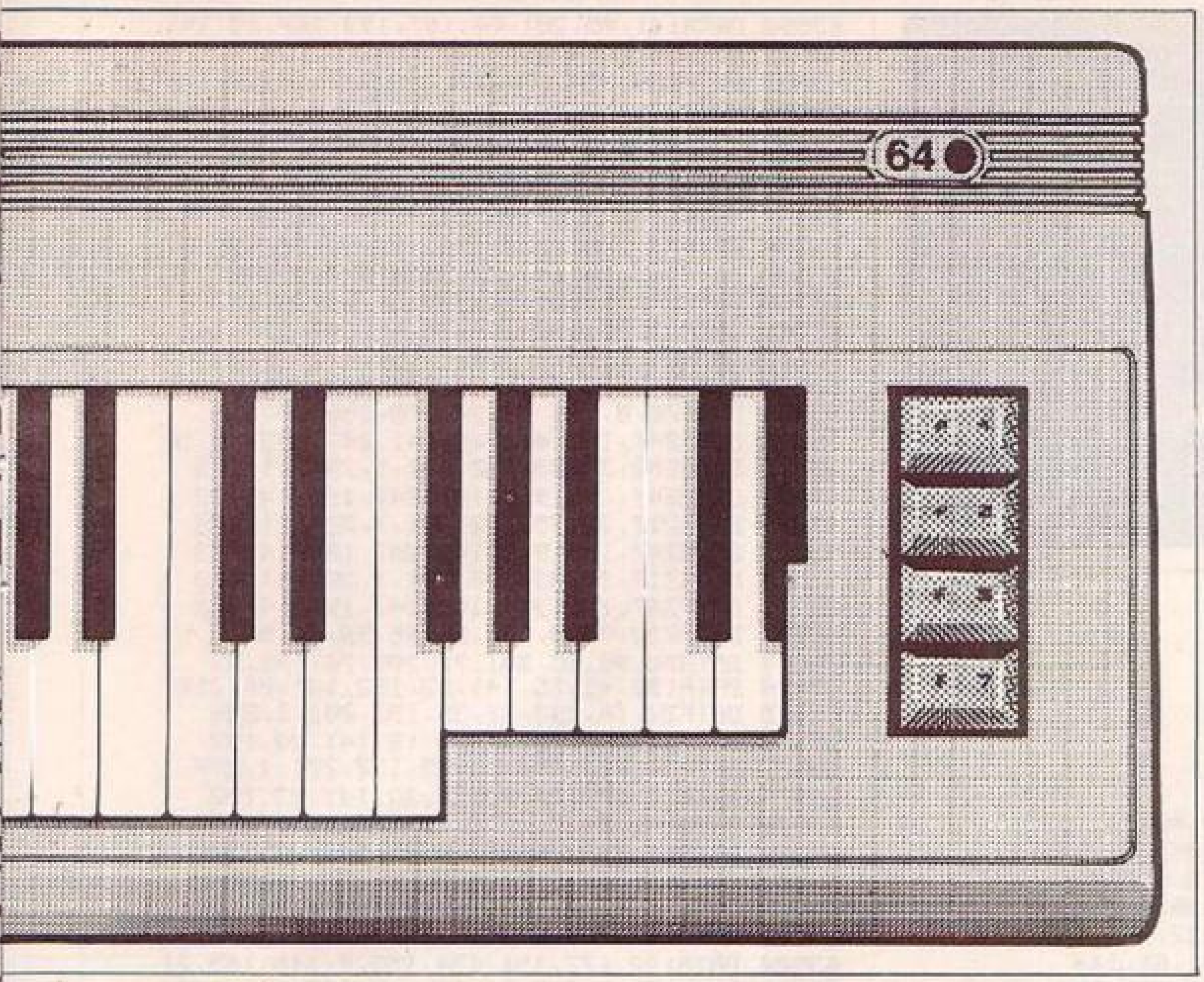
The duration can be any value from 0-65535; each unit represents 1/60th of a second. Thus 60 will represent a duration of 1 second.

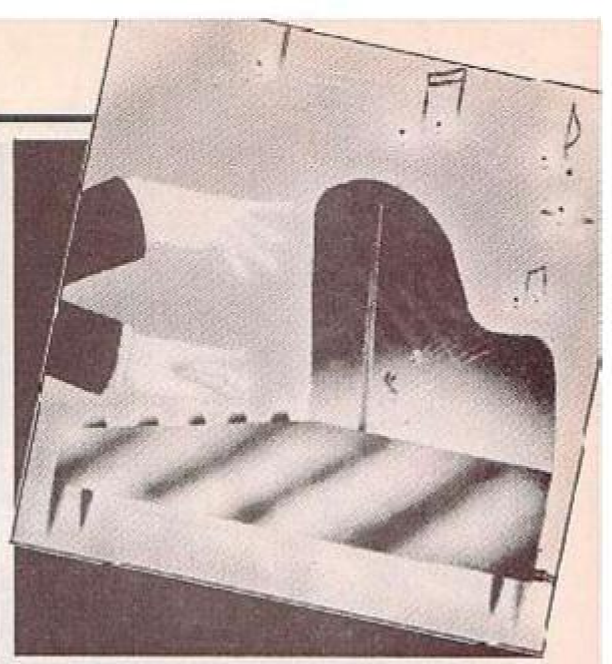
If a value of 0 is used, the note will play continuously until switched off or until another S command is encountered. For example:

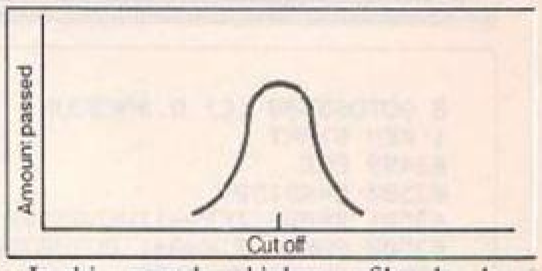
50 SYS 820, S,4000,5000, 6000, 120

■ O (Off). This command is used to zero or switch off all sound addresses (Waveforms,









In this example a high pass filter has been selected.

■ R (Resonance). This is the last filter command which sets the resonance of the filter. The format is:

R,v

v can be from 0-15. For example:

100 SYS 820,R,14
110 GOTO 10

The last three commands are extremely useful. They allow a program, which plays a tune, to be built in memory using voice 1. When the program is executed, it plays in the background, allowing another program to run simultaneously. This is very effective for designing games, allowing the game to be played while music plays in the background. The music can even play while you are programming, and adjustments can be made to the music program — Volume, Waveform, Envelope etc. — while it is actually playing. Because only voice 1 is used, voices 2 and 3 are left free for additional sound effects.

■ N (New). This will rub out any tune in memory. It should be used before making up a tune. The format is:

N

For example:

110 SYS 820,N

■ D (Data). This will store the next note and duration in memory. Format is:

D,n,d

n can be any number from 0-65000. See Sound command; line 50.

d (duration) can be 0-255. (60 is equal to 1 sec). For example:

120 SYS 820,D,2000,120

These values could be read from a data statement — see program 2.

■ X (Execute). When your tune is finished, this command will cause it to play. Format:

X

For example: 130 SYS 820,X

When a program, which plays a tune, is run, the tune will repeat until the O (Off) command is encountered.

Although constants have been used for the values in the above examples, it is permissible to use variables for the values in any of the commands — as has been done in the demonstration programs. *(continued on next page)*

USK64

Volumes etc.). This usually takes about 20 secs. in Basic, but this new command does it almost instantaneously.

The format is:

O,v

v can be from 1 to 3.

A value of 1 clears voice 1; 2 clears voices 1 and 2, while 3 clears all three voices. Any value clears all filters and the volume.

The following four commands are used to set the sound filters. The filters are used to change the harmonic structure of the wave. With the 64 we have three different types of filtering. These may be used separately, or two or more can be used simultaneously. There are a number of controls which must be set when using a filter.

■ F (Filter set). This command defines which voices are to be filtered and which not. The format is

F,v1,v2,v3

If v is given the value 1, then that voice will be filtered — if v is zero, that voice will not be filtered. For example:

70 SYS 820,F,1,0,1

In this case, voices one and three will be filtered while voice two remains unchanged.

The next three commands will only affect the voices you have selected to be filtered. There is not a different filter for each voice — the chosen filter will act on all the voices you have decided to filter.

■ C (Cut-off point). This tells the computer the exact stage in the wave cycle where the filtering process must begin — it is a reference point for the filter. The format is:

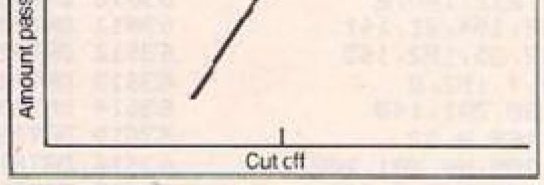
C,v

v can be any value from 0-255. For example:

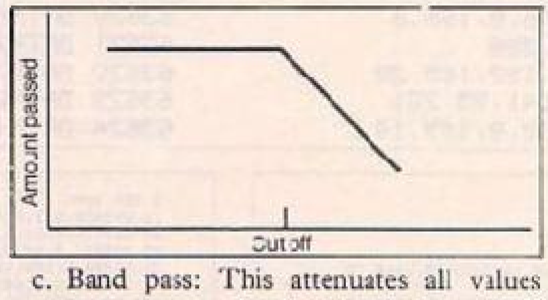
70 SYS 820,C,100

■ M (Filter mode). This command defines the type of filter to be used. The 64 has three filter modes, which can be combined.

a. Highpass: This passes over all values above the cut-off point while attenuating the frequencies below.



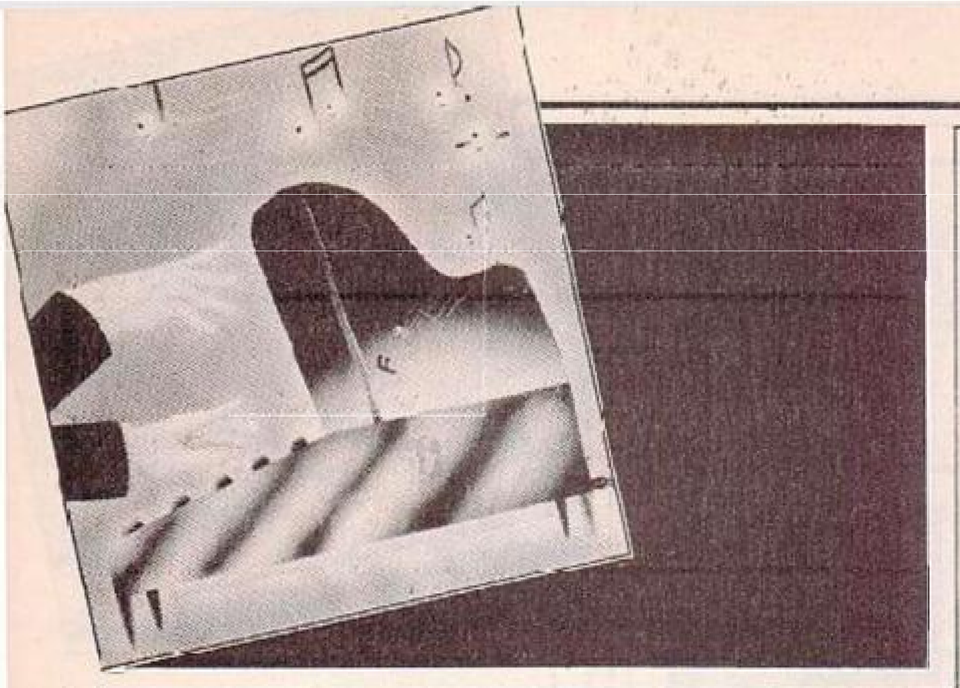
b. Low pass: This passes over all the low frequencies while attenuating the others.



c. Band pass: This attenuates all values except a narrow band around the cut-off point.

The format is: M,HP,LP,BP

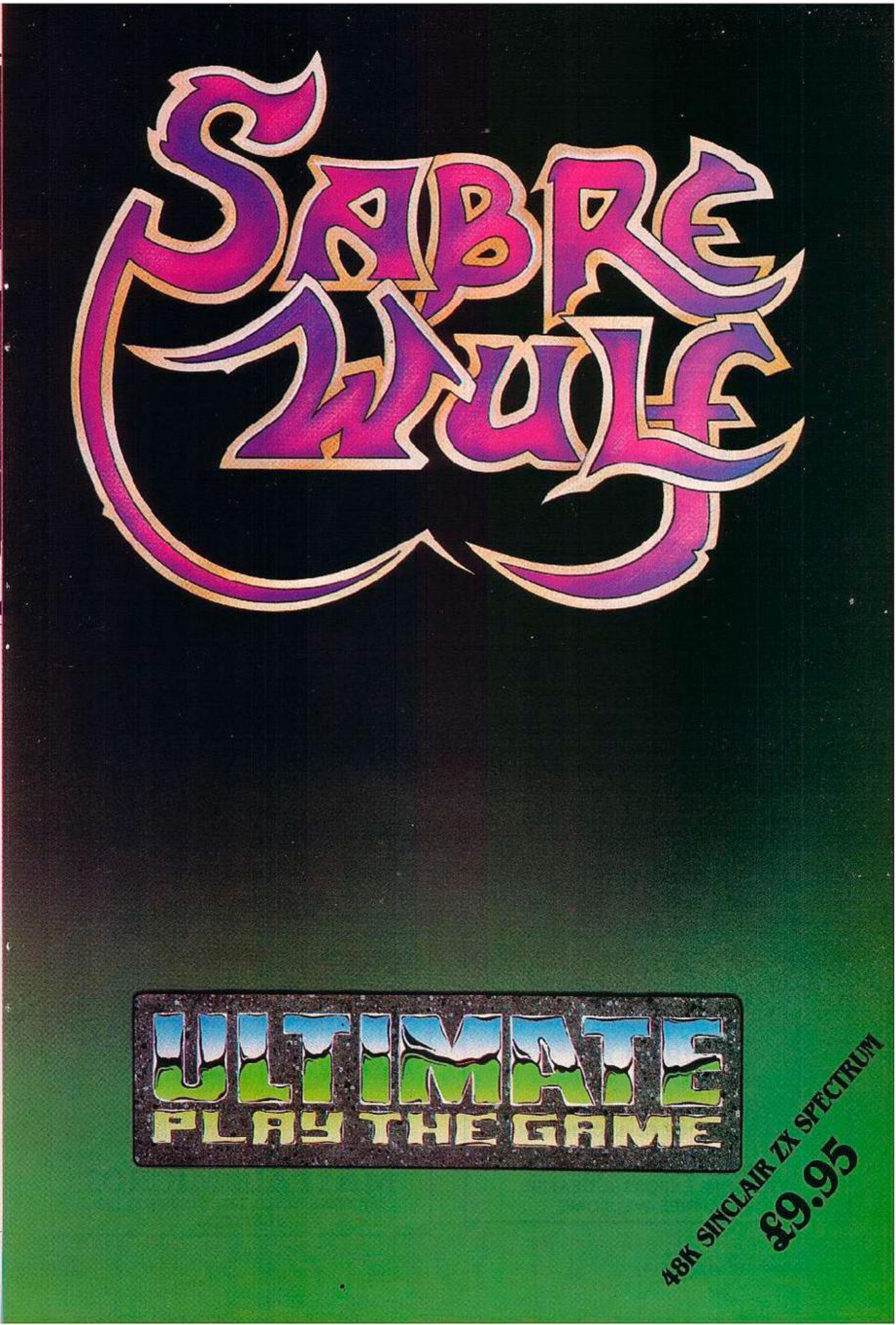
A value of 1 sets that type of filter while 0 clears it. For example: 80 SYS 820,M,1,0,0



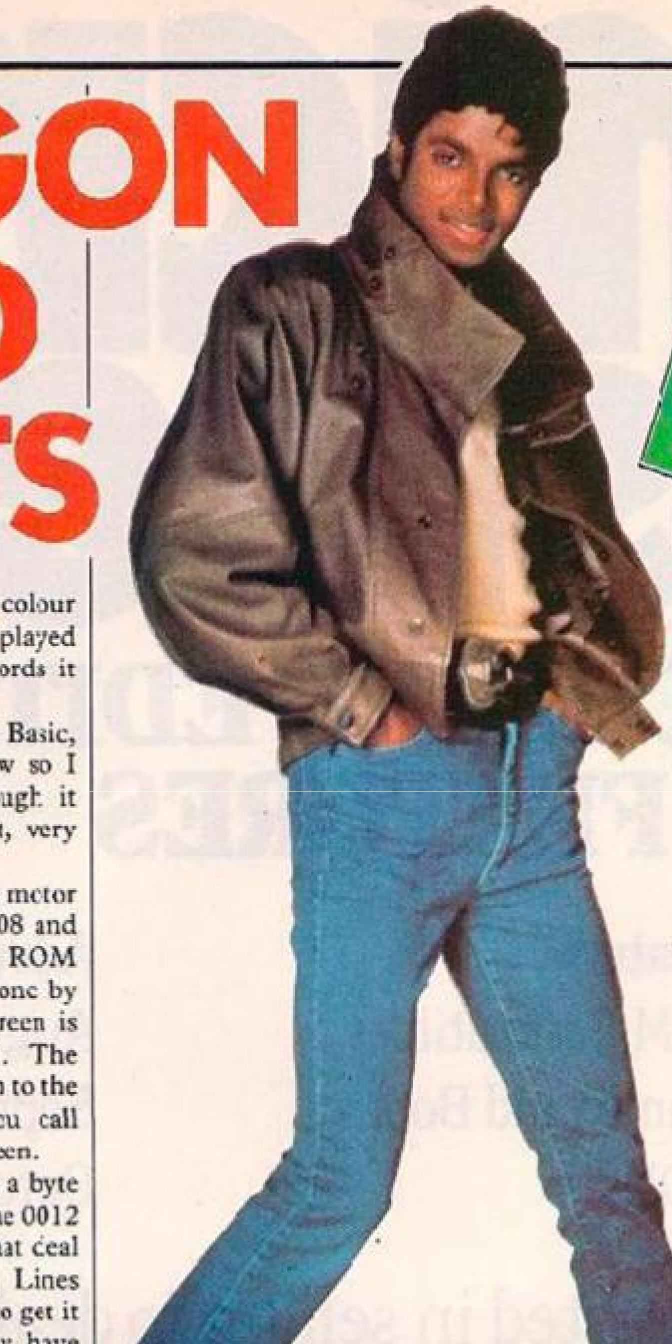
```
0 GOTO63500:(C) G.BARBOUR
1 REM START
63499 END
63500 A=49152
63501 READB:IFB=-1THEN63503
63502 POKEA,B:A=A+1:GOTO63501
63503 SYS50192:GOTO1
63504 DATA169,76,141,52,3,169,48,141,53
63505 DATA3,169,192,141,54,3,95,230,122
63506 DATA208,2,230,123,96,0,0,0,198
63507 DATA122,201,255,208,2,198,123,0,32
63508 DATA253,174,32,158,173,32,247,183,165
63509 DATA20,96,0,32,115,0,201,65,144
63510 DATA9,201,91,176,5,76,69,192,234
63511 DATA234,162,11,108,0,3,141,0,201
63512 DATA201,86,208,20,32,16,192,32,35
63513 DATA192,169,240,45,23,192,76,208,193
63514 DATA234,234,234,234,234,234,201,87,208
63515 DATA38,32,16,192,32,35,192,165,20
63516 DATA141,4,212,141,96,201,32,35,192
63517 DATA155,20,141,11,212,141,97,201,32
63518 DATA35,192,165,20,141,18,212,76,250
63519 DATA192,0,0,201,69,208,55,32,16
63520 DATA192,32,35,192,165,20,141,5,212
63521 DATA32,35,192,165,20,141,6,212,32
63522 DATA35,192,165,20,141,12,212,32,35
63523 DATA192,165,20,141,13,212,32,35,192
63524 DATA165,20,141,19,212,32,35,192,165
63525 DATA20,141,20,212,76,0,196,0,201
63526 DATA80,208,55,32,16,192,32,35,192
63527 DATA165,20,164,21,141,2,212,140,3
63528 DATA212,32,35,192,165,20,164,21,141
63529 DATA9,212,140,10,212,32,35,192,165
63530 DATA20,164,21,141,16,212,140,17,212
63531 DATA76,0,196,0,0,0,0,141,98
63532 DATA201,76,0,196,201,83,208,124,32
63533 DATA16,192,32,35,192,165,20,164,21
63534 DATA141,0,212,140,1,212,32,35,192
63535 DATA165,20,164,21,141,7,212,140,8
63536 DATA212,32,35,192,165,20,164,21,141
63537 DATA14,212,140,15,212,32,35,192,165
63538 DATA20,164,21,201,0,208,7,192,0
63539 DATA208,3,76,0,196,141,80,201,140
63540 DATA81,201,152,0,160,0,169,0,32
63541 DATA219,255,32,222,255,205,80,201,208
63542 DATA248,236,81,201,208,243,169,0,141
63543 DATA0,212,141,1,212,141,7,212,141
63544 DATA8,212,141,14,212,141,15,212,141
63545 DATA80,201,141,81,201,76,0,196,0
63546 DATA0,0,0,0,0,0,201,79,208
63547 DATA97,32,16,192,32,35,192,165,20
63548 DATA201,1,208,0,169,7,141,85,201
63549 DATA76,167,193,201,2,208,8,169,14
63550 DATA141,85,201,76,167,193,169,25,141
63551 DATA85,201,168,0,169,0,153,0,212
63552 DATA200,204,85,201,208,247,169,0,141
63553 DATA23,192,141,24,212,169,0,141,23
63554 DATA212,141,247,193,76,224,195,0,0
63555 DATA0,0,0,0,0,141,23,192,165
63556 DATA20,13,23,192,141,23,192,141,24
63557 DATA212,76,0,196,96,96,96,96,201
63558 DATA67,208,17,32,16,192,32,35,192
63559 DATA165,20,141,22,212,76,0,196,0
63560 DATA96,96,201,82,208,34,32,16,192
63561 DATA32,35,192,169,15,45,247,193,141
63562 DATA247,193,173,247,193,6,20,6,20
63563 DATA6,20,6,20,5,20,141,247,193
63564 DATA76,0,196,96,201,70,208,76,173
63565 DATA247,193,41,240,141,247,193,32,16
63566 DATA192,32,35,192,201,1,208,11,173
63567 DATA247,193,9,1,141,247,193,141,23
63568 DATA212,32,35,192,201,1,208,11,173
63569 DATA247,193,9,2,141,247,193,141,23
63570 DATA212,32,35,192,201,1,208,11,173
63571 DATA247,193,9,4,141,247,193,141,23
63572 DATA212,76,0,196,96,96,96,96,96
63573 DATA96,96,96,201,77,208,76,173,23
63574 DATA192,41,15,141,23,192,141,24,212
63575 DATA32,16,192,32,35,192,201,1,208
63576 DATA11,173,23,192,9,16,141,23,192
63577 DATA141,24,212,32,35,192,201,1,208
63578 DATA11,173,23,192,9,32,141,23,192
63579 DATA141,24,212,32,35,192,201,1,208
63580 DATA11,173,23,192,9,64,141,23,192
63581 DATA141,24,212,76,0,196,96,96,96
63582 DATA96,0,201,68,208,97,172,191,194
63583 DATA192,255,240,85,32,16,192,32,35
63584 DATA192,172,191,194,153,0,149,165,21
63585 DATA153,0,150,32,35,192,172,191,194
63586 DATA153,0,151,76,19,195,172,191,194
63587 DATA153,0,152,165,21,153,0,153,32
63588 DATA35,192,172,191,194,153,0,154,32
63589 DATA35,192,172,191,194,153,0,155,165
63590 DATA21,153,0,156,32,35,192,172,191
63591 DATA194,153,0,157,200,140,191,194,76
63592 DATA0,196,0,0,0,0,0,0,162
63593 DATA16,108,0,3,234,234,234,234,234
63594 DATA201,78,208,50,169,0,169,0,153
63595 DATA0,149,153,0,150,153,0,151,153
63596 DATA0,152,153,0,153,153,0,154,153
63597 DATA0,155,153,0,156,153,0,157,200
63598 DATA192,0,208,224,141,191,194,32,16
63599 DATA192,76,0,196,0,0,0,0,0
63600 DATA201,88,208,92,169,1,141,112,201
63601 DATA141,114,201,141,116,201,169,0,141
63602 DATA113,201,141,115,201,141,117,201,234
63603 DATA234,234,234,234,234,120,169,149,141
63604 DATA20,3,169,195,141,21,3,88,32
63605 DATA16,192,76,0,196,96,96,95,72
63606 DATA138,72,152,72,205,112,201,173,112
63607 DATA201,201,0,208,46,172,113,201,169
63608 DATA0,141,4,212,185,0,149,141,0
63609 DATA212,185,0,150,141,1,212,185,0
63610 DATA151,141,112,201,200,140,113,201,173
63611 DATA96,201,141,4,212,204,191,194,208
63612 DATA5,160,0,140,113,201,104,168,104
63613 DATA170,104,76,49,234,96,96,96,96
63614 DATA96,96,120,169,49,141,20,3,169
63615 DATA234,141,21,3,88,76,0,195,96
63616 DATA96,197,96,96,79,204,96,96,225
63617 DATA96,226,96,96,96,11,212,160,0
63618 DATA177,122,201,59,240,1,96,76,48
63619 DATA192,96,96,96,96,160,0,185,13
63620 DATA0,217,35,196,208,8,200,192,13
63621 DATA208,243,76,0,192,0,67,41,32
63622 DATA71,45,66,65,82,66,79,85,82
63623 DATA0,96,255,255,255,255,255,255,255
63624 DATA-1
```

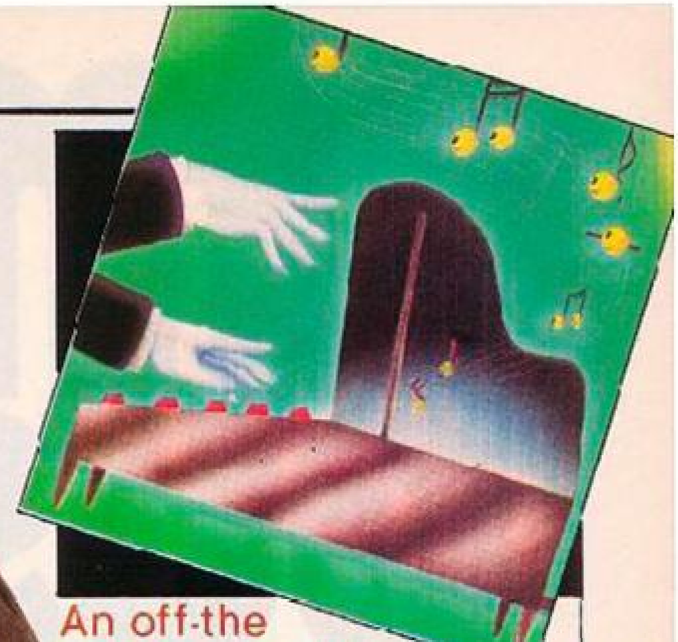
```
1 REM DEMO OF REAL TIME MUSIC
10 SYS820,D,3:N:V,15:W,17,0,0:E,64,128,0,0,0,0
20 READA:IFA=-1THEN3000
30 READB:SYS820,D,A,B:GOTO20
1000 DATA2408,15,2703,15,2864,30,2703,30,2408,30,2408,15,2703,15,2864,15
1010 DATA 3608,15,2703,15,2864,15,2408,30
1020 DATA2408,15,2703,15,2864,30,2703,30,2408,30,2408,15,2703,15,2864,15
1030 DATA 3608,15,2703,15,2864,15,2408,30
1040 DATA2864,15,3215,15,3608,15,3608,15,3608,15,3608,15,3608,15,3215,15,2703,15
1050 DATA2864,15,3215,15,3215,15,3215,15,3215,15,3215,15,2864,15,2408,15
1060 DATA2703,15,2864,30,2703,30,2408,30,2408,15,2703,15,2864,15,3608,15,2703,15
1070 DATA 2864,15,2408,30
2000 DATA-1
3000 SYS820,X
```

```
1 REM DEMO
10 SYS820,C,3:E,144,144,144,144,144,144:V,15:W,65,33,65:F,20000,0,50000
20 SYS820,S,3215,0,0,60:S,3215,6430,0,60:S,3213,6430,12860,60
25 SYS820,S,6430,12860,25721,60
30 READN,L:IFN=-1THEN100
40 SYS820,S,N,N*2,N,L*30:GOTO30
100 DATA6430,.5,6430,.5,8101,.5,10814,.5,9634,.5,8101,.5,6430,.5,8101,1
110 DATA8101,.5,8101,1
120 DATA6430,.5,6430,.5,8101,.5,10814,.5,9634,.5,8101,.5,6430,.5
130 DATA7217,1,7217,.5,7217,1
140 DATA6430,.5,6430,.5,8101,.5,10814,.5,9634,.5,8101,.5,6430,.5,8101,1
150 DATA8101,.5,8101,1
160 DATA6430,.5,6430,.5,8101,.5,10814,.5,9634,.5,8101,.5,6430,.5,8101,1
170 DATA6430,.5,6430,1,-1,-1
```


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DRAGON DISCO LIGHTS





An off-the wall concept from Ron Gardler. Impress PYTs with your ability to fade away and radiate.

THIS PROGRAM generates on-screen colour graphics in time with music that is played through the cassette port. In other words it simulates disco lights.

I had originally programmed this in Basic, but as usual, it proved to be too slow so I converted it to machine code. Although it sounds very complicated it is, in fact, very simple.

The first job is to turn the cassette motor and audio on; this is done in lines 0008 and 0009. Both lines call the respective ROM routines although it is just as easily done by the controlling program. Then the screen is cleared to black — lines 0010,0011. The ROM routine at 47737 clears the screen to the character in accumulator B — if you call 47735 then the screen is cleared to green.

The guts of the program come next; a byte is taken from the cassette recorder in line 0012 — this ROM routine is one of many that deal with the cassette port, see figure 1. Lines 0013-0027 then divide this byte by 31 to get it into the range of 0-8 because we only have nine colours. Lines 0028-0044 then send control to a routine which places the graphics on screen.

These are all very similar so we will just look at the first one. The first line of all the routines looks at the top right-hand corner of the graphics to see if it is On — colour — or Off — black. If it is On then it is turned Off and visa versa. Control is then passed back to the "byte-in" routine and the whole process is repeated.

To enter the program use the hex loader to enter the code from the hex dump. When you've finished save it by typing:

CSAVEM"DISCO",&H6000,&H6114,&H6003

When the program is in memory place a music cassette into your cassette recorder and press Play. Type

EXEC &H6003

and hit Enter. If all is well then you should see some coloured graphics appearing on your screen and the music should be playing through the speaker, if not then reload the code and check through it.

Program 2.

```
24576 : 4EC000BDB015BDBA = 791
24584 : ECC680BDBA79BDB0 = 1375
24592 : 24B76000B61FB760 = 759
24600 : 01E608B76002F660 = 766
24608 : 004F5849B1600125 = 551
24616 : 04E060015C7A6002 = 589
24624 : 26F0910127229102 = 612
24632 : 273381032744B104 = 462
24640 : 27558105276681 06 = 534
24648 : 27778107102700 86 = 483
24656 : 81C81027009320B6 = 555
24664 : B6C400B1BF2704C5 = 699
24672 : BF2002C680BE0400 = 649
24680 : 17C09520A1B60408 = 562
24688 : 819F2704C69F2002 = 722
24696 : C6E0BE040B170080 = 634
24704 : 20BCB60416B1AF27 = 723
24712 : 04C6AF2002C680BE = 879
24720 : 0416BD6C16FF77B6 = 853
24728 : 04A0B1BF2704C6BF = 916
24736 : 2002C680BE04A080 = 807
24744 : 5716FF62B604B6B1 = 959
24752 : CF2704C6CF2002C6 = 887
24760 : B0EE04B6BD4216FF = 940
24768 : 4DB60540B1DF2704 = 723
24776 : C6DF2002C680BE05 = 928
24784 : 40BD2B16FF3BB605 = 770
24792 : 4BB1EF2704C6EF20 = 955
24800 : 02C680BE054BBD1B = 715
24808 : 16FF23B6055681FF = 969
24816 : 2704C6FF2002C680 = 856
24824 : BE05568D0316FF0E = 668
24832 : 1F9BCA0B10BF0008 = 554
24840 : A7E0313F26FA3088 = 879
24848 : 165A26F039 = 447
```

Figure 1.

I/O routines in ROM.

&H8015..... turn the motor on.
&H8018..... turn the motor off.
&H801B..... prepare cassette for writing.
&H801E..... put out byte to cassette from A.
&HA008..... outputs a block of data.
&H8021..... prepares cassette for input.
&H8024..... input a byte (into A).
&H8027..... input a bit (into carry bit of CC).
&HA006..... get block in.

Locations used by the above routines.

&H90/91..... leader byte count.
&H95/96..... cassette motor delay.
&H7C........ block type: 0 = file header. 1 = data 255 = end of file.
&H7E/7F.... base address of bytes to put out.
&H81.......... error code, cleared if read and verified correctly.

To achieve the best results adjust the cassette volume and the colour/brightness controls of your television and then turn the lights out.

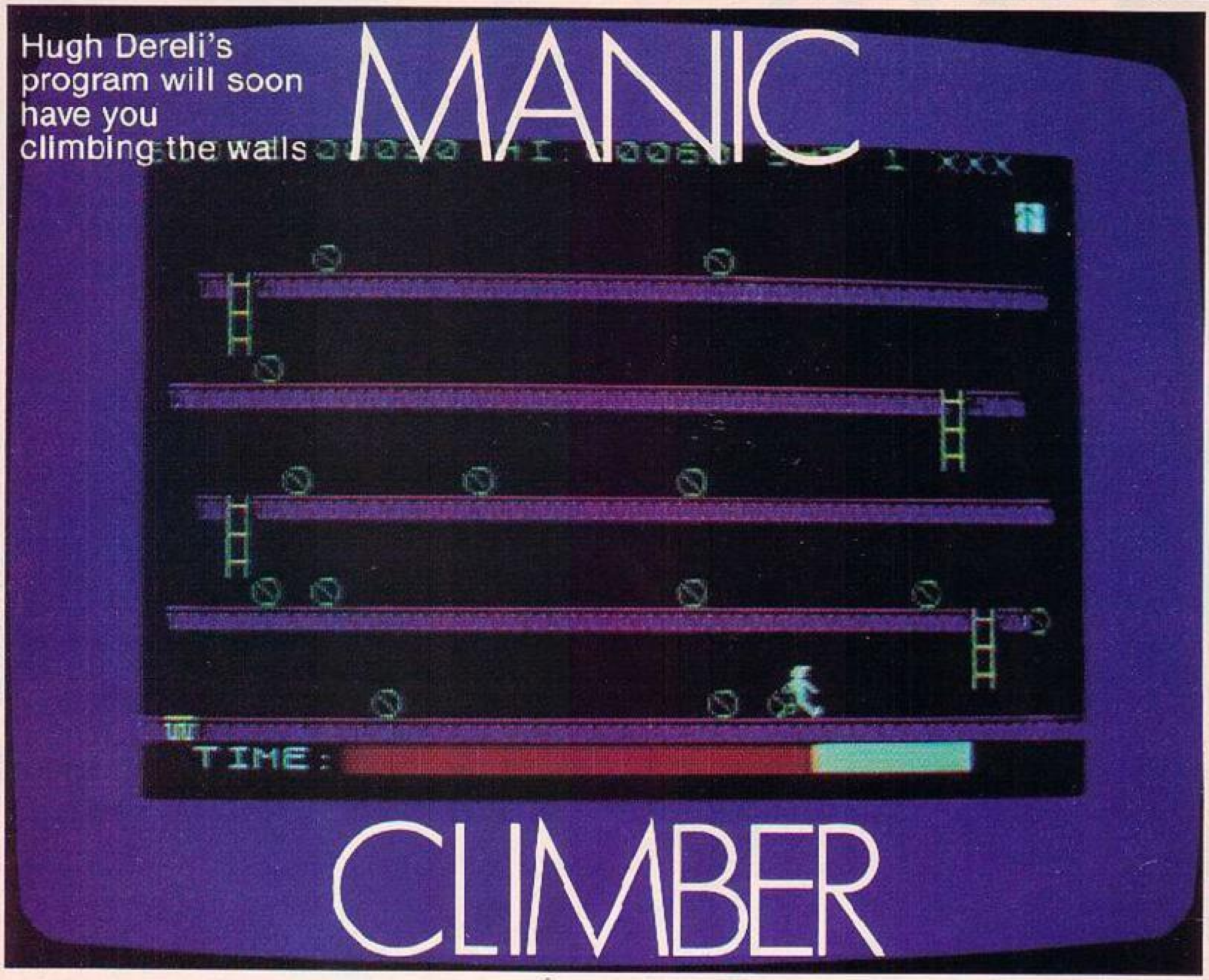
If anyone does not wish to type in all the data then please send £2, an S.A.E. and a blank cassette to: R. Gardler, 23 Dorchester Road, Hazel Grove, Stockport SK7 5JR. ■

Program 1. The hex loader.

```
10 REM HEXLOADER
20 REM ENTER THE STRING OF HEX DIGITS FIRST
30 REM AND THEN THE CHECKSUM
50 FOR N = 24576 TO 24852 STEP 8
60 PRINT N;": ";
65 TT=0
70 INPUTA$
75 Z=0
80 FOR G=1 TO LEN(A$) STEP 2
90 P=VAL("&H"+MID$(A$,G,2))
95 TT=P+TT:POKE (N+Z),P
100 Z=Z+1
110 NEXT
120 PRINT" = ";
130 INPUT T$
150 IF VAL(T$)<>TT THEN PRINT "ERROR":GOTO 50
160 NEXT
```

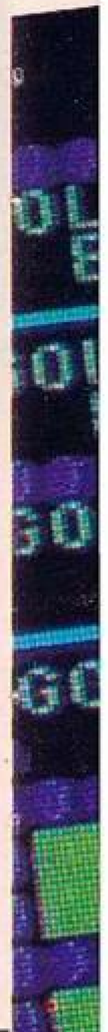


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MANIC CLIMBER

Hugh Dereli's program will soon have you climbing the walls



Listing 2.

```
29300 7E 00 01 03 03 01 03 =73
29307 07 0B 13 03 03 03 06 =52
29314 0C 18 0C 00 E0 30 C0 =636
29321 80 C0 E0 D0 C8 30 C0 =1336
29328 C0 60 34 1C 08 00 07 =383
29335 03 03 01 03 07 38 13 =47
29342 07 03 03 06 2C 38 10 =131
29349 00 80 C0 C0 80 30 E0 =1056
29356 D0 C8 C0 C0 C0 50 30 =1128
29363 18 30 00 1E 3C 3C 18 =246
29370 3C 7E 7E 7E 7E 3C 3C =684
29377 18 18 18 1C 00 78 3C =280
29384 3C 18 3C 7E 7E 7E 7E =648
29391 3C 3C 18 18 18 38 3C =308
29398 42 A1 91 89 85 42 3C =768
29405 3C 42 A1 91 89 35 42 =768
29412 3C FF 00 DD 55 55 55 =791
29419 77 00 42 42 42 7E 42 =509
29426 42 42 42 EF C7 4B 6D =916
29433 EF EF EF EF 00 3C 7E =1142
29440 00 7E 3C 00 00 3C 42 =312
29447 85 89 91 A1 42 3C 10 =718
29454 92 54 38 10 D6 38 10 =588
29461 81 42 24 18 18 24 42 =381
29468 81 00 00 00 00 00 00 =129
29475 00 00 00 00 00 00 00 =0
29482 00 00 00 00 00 00 00 =0
29489 00 00 00 00 00 00 00 =0
29496 00 00 00 00 C3 7E 78 =441
29503 C3 75 77 21 00 58 01 =553
29510 C0 02 3A F0 5B 57 72 =784
29517 23 0B 78 B1 20 F9 C9 =825
29524 3A CA 73 FE A2 20 06 =829
29531 3E 9D 32 CA 73 C9 3E =349
29538 A2 32 CA 73 C9 AF 32 =755
29545 90 5C 3E 15 D7 AF D7 =724
29552 1E 02 21 4A 5B E5 4E =537
29559 23 46 23 3E 20 16 07 =263
29566 CD EB 73 04 CD D4 73 =1097
29573 FE 44 28 23 FE 04 28 =497
29580 36 FE 07 28 32 05 56 =496
29587 FE 43 20 1D CB 42 20 =683
29594 05 CB C2 72 18 14 F5 =805
29601 7A CB C7 FF FF CB 87 =1355
29608 77 F1 18 17 01 1F 01 =440
29615 3E 01 77 18 0F C5 79 =539
29622 82 4F CD D4 73 FE 04 =999
29629 20 03 C1 18 01 F1 E1 =719
29636 71 23 70 23 23 3E 9D =549
29643 16 04 CD EB 73 1D 20 =542
29650 A2 C9 E5 D5 C5 68 26 =1144
29657 00 29 29 29 29 29 06 =211
29664 00 09 01 00 58 09 7E =233
29671 C1 D1 E1 C9 D5 E5 F5 =1515
29678 7A 32 8F 5C C5 3E 16 =688
29685 D7 C1 78 C5 D7 C1 79 =1254
29692 C5 D7 C1 F1 F5 C5 D7 =1503
29699 C1 F1 E1 D1 C9 3E FF =1386
29706 32 90 5C 3E 15 D7 3E =646
29713 01 D7 ED 4B FA 5B CD =1074
29720 C7 75 3A FC 5B 57 CB =1007
29727 5A 28 4F 04 C4 CD D4 =634
29734 73 05 05 FE C6 F5 28 =670
29741 0B 3E 06 04 CD D4 73 =615
29748 05 FE 06 30 15 C5 01 =516
29755 FE FE ED 78 C1 CB F7 =1508
29762 FE FF 28 05 F1 04 C3 =994
29769 CB 74 F1 18 7D F1 FE =1204
29776 03 28 78 FE 46 28 74 =643
29783 FE 04 28 70 FE 43 20 =773
29790 6C 3A FD 5B FE 03 20 =796
29797 65 04 21 FE 5B 34 CD =740
29804 E6 75 C3 9A 75 C5 04 =1014
29811 CD D4 73 C1 FE 06 26 =1025
29818 4C C5 04 0C CD D4 73 =821
29825 C1 FE 06 28 41 C5 04 =759
29832 04 CD D4 73 C1 FE 03 =986
29839 28 3A FE 4A 28 36 FE =770
29846 06 28 32 FE 43 28 2E =503
29853 C5 04 04 0C CD D4 73 =749
29860 C1 FE 03 28 22 FE 46 =848
29867 28 1E FE 06 28 1A FE =650
29874 43 28 16 3A FD 53 FE =785
29881 00 20 0F 04 21 FE 5E =429
29888 34 CD E6 75 C3 9A 75 =1370
29895 F5 C3 39 74 3A FE 5E =1316
29902 5F AF 32 FE 5B 3E 05 =732
29909 BB DA 70 77 3A FD 5B =1038
29916 FE 00 20 3D C5 01 FE =779
29923 FB ED 78 C1 CB F7 FE =1505
29930 FF 28 30 3E 05 CD 37 =658
29937 76 FE 00 20 27 C5 05 =645
29944 CD D4 73 C1 FE 03 2E =1022
29951 1D 5F 3A FC 5B CB 5F =823
29958 7B 20 3B C5 0C 05 CD =585
29965 D4 73 C1 FE 03 28 09 =826
29972 05 3E 07 32 FD 5B CD =673
29979 15 76 3A FD 5B FE 00 =795
29986 28 04 3D 32 FD 5B C5 =696
29993 01 FE 3F ED 78 C1 CB =1231
30000 F7 FE FE 20 2C 3A FC =1141
30007 5B CB 5F 3E 90 C5 20 =824
30014 03 CA 08 0C 32 FC 5B =414
30021 3E 1F B9 20 06 0D 3E =391
30028 98 32 FC 53 3E 03 CD =815
30035 37 76 E1 FE 00 20 07 =699
30042 44 4D 3E 98 32 FC 5B =752
30049 C5 01 FE DF ED 78 C1 =1225
30056 CB F7 FE FD 20 2C 3A =1091
30063 FC 5B CB 5F C5 3E 9A =1054
30070 28 03 D6 06 0D 32 FC =578
30077 5B 3E FF B9 20 06 0C =643
30084 3E 9A 32 FC 5B 3E 03 =674
30091 CD 37 76 E1 FE 00 28 =897
30098 07 44 4D 3E 9A 32 FC =670
30105 5B ED 43 FA 5B CD C7 =1140
30112 75 21 B0 5C 36 00 3E =534
30119 04 CD 37 76 FE 00 28 =676
30126 02 CB C6 3E 47 CD 37 =796
30133 76 FE 00 28 02 CB CE =825
30140 3E 05 CD 37 76 FE 00 =699
30147 C8 CB D6 C9 C5 3A FC =1325
30154 5B 16 07 CD EB 73 04 =679
30161 3C CD CD 73 CD 5F C1 =1106
30168 C0 0C 3C CD EB 73 3C =879
30175 04 CD EB 73 05 0D C9 =778
30182 C5 3A FE 5B 87 87 57 =957
30189 87 87 82 6F 26 00 11 =566
30196 5A 00 19 3E 02 11 64 =296
30203 00 D5 E5 F5 CD B5 03 =1076
30210 F1 E1 D1 01 06 00 09 =691
30217 EB 01 07 00 ED 42 EB =781
30224 3D 20 E9 C1 C9 C5 11 =934
30231 14 00 3E 04 21 CB 00 =319
30238 D5 E5 F5 CD B5 03 F1 =1317
30245 E1 D1 01 06 00 ED 42 =744
30252 EB 01 CA 00 09 EB 3D =551
30259 20 E9 C1 C9 C5 57 CD =1148
30266 53 76 C4 CD 53 76 3A =669
30273 FC 5B CB 5F 20 08 0C =693
30280 CD 53 76 05 CB 53 76 =817
30287 3E 00 C1 C9 CD D4 73 =988
30294 BA C0 C1 C1 3E 01 C9 =1C28
30301 3E 15 D7 AF D7 AF 32 =913
30308 90 5C 21 64 5B 1E 01 =491
30315 E5 46 23 4E 23 D5 16 =6E2
30322 07 3E 20 CD EB 73 0C =668
30329 0C CD EB 73 0D CD EB =1C20
30336 73 0D E1 55 CB 7A 20 =720
30343 4B 7A CB 3F CB 3F CB =932
30350 3F CE 3F E6 07 C6 03 =767
30357 D8 2C 04 CD FE 18 35 =754
30364 CD 49 77 F5 05 F1 28 =928
30371 20 E5 D5 C5 3E 15 D7 =982
30378 3E 01 D7 3E FF 32 90 =789
30385 5C EE 4B FA 5B CD C7 =1149
30392 75 05 CD C7 75 ED 43 =947
30399 FA 5E AF 32 FD 5B 3E =972
30406 15 D7 AF D7 AF 32 90 =995
30413 5C C1 D1 E1 18 3D 7A =926
30420 E6 0F C6 05 88 20 04 =668
30427 CD 8E 18 31 CD 49 77 =863
30434 F5 04 F1 28 29 E5 05 =1013
30441 C5 3E 15 D7 3E 01 D7 =773
30448 3E FF 32 90 5C ED 4B =915
30455 FA 5E CD C7 75 04 CD =1071
30462 C7 75 ED 43 FA 5B 3E =1025
30469 15 D7 AF D7 AF 32 90 =995
30476 5C C1 D1 E1 D5 16 03 =957
30483 3E 82 CD EB 73 0C 0C =772
30490 CD EE 73 04 0D 3E A4 =798
30497 CD EE 73 05 3E 8F CD =970
30504 E8 73 3E 85 04 0D 16 =584
30511 01 CE CD 73 0C 0C 3E =645
30518 8A CD EB 73 0D 0D 05 =724
30525 D1 E1 70 23 71 23 23 =764
30532 13 C2 6B 76 C9 3A FB =958
30539 59 3C 3C B8 20 1B 3A =513
30546 FA 5E B9 30 0F 3C 39 =834
30553 20 11 3A FC 5B CB 5F =748
30560 20 06 AF FE 01 C9 3D =734
30567 37 3F B9 3A F4 AF FE =1039
30574 03 C5 CD C7 75 18 2F =793
30581 ED 73 F8 5B ED 4B FA =1253
30588 5B CD C7 75 CD 9A 77 =1090
30595 CD DE 77 CD BF 77 CD =1263
30602 E7 77 CD 9A 77 CD BF =1224
30609 77 CE 36 78 CD D8 79 =1043
30616 13 E6 CD 08 74 3A B0 =817
30623 5C CE 47 28 08 01 F4 =659
30630 01 ED 78 F6 5B C9 CB =1104
30637 57 C4 C6 77 CB 4F CB =1082
30644 3A 7E 78 FE 00 C0 01 =748
30651 D0 07 18 E8 06 05 FB =733
30658 75 10 FD C9 21 7B 78 =864
30665 35 3E 15 D7 AF D7 ED =978
30672 43 F4 5B CD C7 75 01 =938
30679 E8 03 18 CC 3A D8 5B =831
30686 FE 00 C8 32 6A 76 C3 =923
30693 5D 76 CD 54 73 3A E0 =897
```

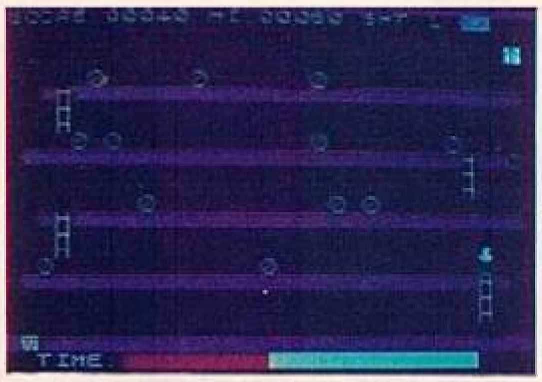
Listing 1.

```
 2 REM ENTER CODE
 5 CLEAR 29300
 10 LET a=10: LET b=11: LET c=1
2: LET d=13: LET e=14: LET f=15
 15 INPUT "START ADDRESS>":add
 17 LET check=0
 19 PRINT add;TAB 6;
 20 FOR h=1 TO 7
 30 INPUT LINE i$: POKE add,VAL
i$(1)*16+VAL i$(2)
 32 PRINT i$;" ";
 35 LET check=check+PEEK add: L
ET add=add-1
 40 NEXT h
 45 PRINT "=";CHECK
 50 GO TO 17
 55 REM CHECK CODE
 60 INPUT "START ADDRESS>":add
 65 PRINT add;" ";
 70 LET check=0
 75 FOR f=1 TO 7
 80 LET i=PEEK add
 82 LET j=INT (i/16)
 85 PRINT CHR$ (j+48+(j>9)*7);C
HR$ (i-j*16+48+(i-j*16>9)*7);" "
;
 90 LET check=check+PEEK add: L
ET add=add+1
 100 NEXT f
 110 PRINT "=";check
 120 GO TO 65
```

In this fast multi-sheet machine-code game for the 16/48K Spectrum, you control Fred the builder who works on a construction site building a skyscraper. Fred must journey up the girders and ladders of the unfinished building to get to the top. Unfortunately, barrels are rolling down the girders towards our hero. Fred must jump over or avoid these. To get onto the next sheet he must collect all the hamburgers first.

Other hazards include lifts and poisoned weeds. You must also be careful that your time doesn't run out and don't fall too far either. If you manage to make it through all nine sheets, the game will begin again only this time the action will be faster. The keys are shown in the centre column of this page.

Q to T	Jump/up ladder
Caps Shift to V	Down ladder
O	Left
P	Right



Now to typing in the game itself. First, type in your favourite hex loader. If you do not have one, use listing 1. This version includes a hex checker as well. Now enter and check the code in listing 2.

Now type:

NEW

Do not worry — the program is above RAMtop and will not be destroyed. Now type in the main Basic listing — listing 3. You can now save the whole program by typing:

SAVE "ManicClimb" LINE 0:SAVE "code" CODE 29300,4000

Now rewind and verify with:

VERIFY "":VERIFY "" CODE

Now, you can load it back in with

LOAD ""

Listing 3.

```
 5 DEF FN a$(s)=("0000"+STR$ s
)(LEN STR$ s TO )
 6 POKE 23675,117: POKE 23676,
114
 10 CLEAR 29300
 20 LOAD ""CODE
 30 LET hi=0
 40 LET b$=CHR$ 13
 42 POKE 30656,5: POKE 31079,0
 50 LET a$=b$+"Mission controls
:-"+b$+b$+"Q-T..........up ladde
r/jump"+b$+"CAPS SHIFT-V.down la
dder"+b$+"O.............left"+b$+
"P.............right"
 55 BORDER 7: INK 0: PAPER 7: C
LS
 60 LET q=.1
 70 FOR f=1 TO LEN a$
 80 PRINT a$(f);: IF a$(f)=CHR$
 13 THEN PAPER 1+RND*6: INK 9
 90 IF INKEY$<>"" THEN GO TO 30
0
 100 LET q=q*1.04: BEEP .05,q
 110 NEXT f
 120 PAUSE 60
 121 FOR f=1 TO 15
 122 FOR q=0 TO 7
 123 BEEP f/500,q
 124 PAUSE 1
 125 BORDER q
 126 IF INKEY$<>"" THEN GO TO 30
0
 127 NEXT q
 129 NEXT f
 130 PRINT #0;TAB 5; FLASH 1;"PR
ESS ANY KEY TO START"
 140 FOR f=0 TO 13 STEP 3: BEEP
.005,f: NEXT f
 150 IF INKEY$="" THEN GO TO 140
 300 LET sc=0: LET f=0: LET s=0
 302 LET li=3
 310 INK 7: PAPER 0: BORDER 0: C
LS
 320 GO SUB 4000
 340 POKE 23659,0: PRINT AT 22,2
;"TIME:"; INK 2; PAPER 7;"██████
██████████████": POKE 23659,2
 345 BORDER 1
 350 POKE 23536,s
 360 PRINT :: RANDOMIZE USR 2950
0
 380 FOR f=1 TO 3: BEEP .15,1: B
EEP .15,5: BEEP .4,1: BEEP .5,-4
0: NEXT f
 390 PRINT :: GO TO USR 29503
 510 BEEP .9,1: BEEP .9,-0: BEEP
 .9,-1
 520 LET li=li-1
 525 LET a$="G A M E  O V E R":
 527 PRINT AT 10,7;
 530 IF li<>0 THEN GO TO 310
 540 FOR f=1 TO LEN a$
 550 PRINT a$(f);
 557 FOR g=1 TO 40: NEXT g
 560 NEXT f
 561 FOR g=0 TO 56 STEP 2:
 565 POKE 23536,c: PRINT :: RAND
OMIZE USR 29506
 567 NEXT g
 570 FOR f=1 TO 800: NEXT f
 580 IF sc>hi THEN LET hi=sc
 590 GO TO 40
 1000 FOR f=13 TO 0 STEP -3: BEEP
 .005,f: NEXT f
 1010 LET sc=sc+20: GO SUB 4000
 1020 GO TO 390
 2000 LET f=42: LET q=16
 2005 POKE 30794,128
 2020 POKE 30531,201
 2021 POKE 23536,f: PRINT :: RAND
OMIZE USR 29506
 2022 LET f=(f=42)*2+(f=2)*42
 2025 PRINT :: LET l=USR 30774: P
OKE 23659,2
 2027 POKE 30531,237
 2029 IF l=50 THEN GO TO 2500
 2030 LET sc=sc+53
 2040 PRINT AT 0,6;FN a$(sc)
 2050 BEEP .004,q: LET q=q-.4
 2060 GO TO 2020
 2500 LET s=s+1
 2505 IF s>8 THEN POKE 30656,PEEK
 30656-2: POKE 31079,PEEK 31079+
1: LET s=0
 2510 GO TO 310
 4000 INK 4: PRINT AT 0,0;"SCORE:
";FN a$(sc);" HI:";FN a$(hi);
 4010 PRINT ;" SHT:";s+1;" ";
 4020 FOR f=1 TO li: PRINT INK 5;
 FLASH 1;"X";: NEXT f
 4030 INK 7: RETURN
```

```
30700 5B FE 00 2E 12 2A E1 =670
30707 5B 22 73 72 32 71 73 =633
30714 2A E3 5B 22 AD 73 CD =887
30721 67 73 39 E5 5B FE 00 =853
30728 28 12 29 E6 5B 22 73 =573
30735 73 32 71 73 2A E8 5B =753
30742 22 AD 73 CD 67 73 3A =803
30749 EA 5B FE 00 28 12 2A =679
30756 ED 5B 22 73 73 32 71 =753
30763 73 2A E3 5B 22 AD 73 =807
30770 CD 67 73 C9 3E 15 D7 =922
30777 AF D7 3E 11 D7 3E 07 =753
30784 D7 3E 10 D7 AF D7 2A =940
30791 7B 78 11 0E 00 A7 ED =671
30798 52 22 73 78 DA A4 77 =857
30805 AF 32 63 5C 7C 06 16 =576
30812 C6 C7 4F 16 3A 3E 8A =561
30819 CB 7D 29 02 3E 8F CD =780
30826 CD 73 02 3E 20 CD ED =896
30833 73 3E 02 32 6B 5C C9 =629
30840 16 13 E5 03 AF 32 21 =532
30847 00 14 22 7E 78 AF 32 =519
30854 90 5C 39 F6 5B 87 87 =895
30861 5F 87 57 87 82 83 5F =808
30868 BD 21 60 7C 16 00 DD =717
30875 19 3E 03 DE 6E 00 DD =642
30882 66 01 5F 23 7E FE C0 =804
30889 38 16 E6 3F 57 23 4E =571
30896 23 46 D5 16 03 3E 9E =563
30903 CD EB 73 D1 0C 15 20 =829
30910 F3 18 29 FE 40 38 16 =699
30917 23 4E 23 46 E6 3F 57 =598
30924 D5 16 06 3E 9F CD EB =902
30931 73 D1 04 1E 20 F3 18 =648
30938 0A 4F 23 46 23 56 23 =350
30945 7E CD EB 73 1D 20 8D =931
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30966 5B AF 32 FE 5B 32 80 =887
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30987 71 DD 46 06 23 70 ED =794
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31001 23 71 DD 46 08 23 70 =594
31008 23 ED 43 AE 73 FE 00 =881
31015 CA D8 79 E3 F5 71 23 =1159
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31036 09 D6 E5 FE 32 71 73 =974
31043 3E 18 32 B0 73 CD 67 =748
31050 73 3E 20 32 B0 73 F1 =804
31057 E1 D1 15 20 E7 DD BE =1129
31064 04 20 DE 01 06 00 DC =486
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31176 ED 73 0C 0D 3E BA CD =779
31183 EB 73 0D 0D F1 B8 20 =833
31190 E1 C9 C1 18 BD 01 FE =1026
31197 FE ED 78 CB F7 FE FC =1567
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31211 F7 FE FC C0 21 02 7A =1102
31218 01 00 00 7E FE 08 CC =598
31225 08 00 CD EB 73 0C 23 =610
31232 18 F3 28 63 29 20 4E =551
31239 2E 43 2E 44 63 72 65 =543
31246 6C 69 0D 11 ED 00 13 =488
31253 DD 01 11 DD 02 08 DD =696
31260 01 09 DD 02 05 43 1C =333
31267 11 43 03 0D 43 18 09 =203
31274 43 03 05 01 15 46 9E =325
31281 1E 15 43 9E 01 11 43 =361
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31295 43 9E 1E C2 47 A0 0E =502
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31316 DD 02 0D DD 01 09 DC =688
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31358 02 47 A0 0E 12 05 A1 =431
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31372 C3 10 0E C3 02 0E C5 =643
31379 0B 06 14 C3 43 9E 1A =293
31386 E0 00 15 D5 03 14 C9 =690
31393 16 13 C5 1A 10 D8 03 =499
31400 0F C5 04 08 DC 0A 0D =456
31407 C4 18 0A C3 1C 0C C6 =667
31414 1A 07 CD 08 06 C5 05 =457
31421 05 C3 02 04 42 1D 10 =317
31428 43 04 0D 43 1E 07 1F =217
31435 13 43 9E 19 0E 43 9E =506
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31449 9E 09 0F 43 9E 18 10 =447
31456 05 A1 05 08 05 A1 15 =366
31463 03 47 A0 00 01 05 A1 =401
31470 01 15 46 9E 0F 14 BB =467
31477 1D E0 00 15 CF 16 10 =514
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31498 04 C3 12 04 CF 16 04 =447
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31533 A0 00 15 46 9E 1F 15 =461
31540 46 9E 11 15 43 9E 10 =507
31547 0C 43 9E 00 0E 43 9E =470
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31561 43 13 05 04 A3 14 05 =379
31568 04 43 0A 05 04 A3 43 =416
31575 01 04 1C 12 05 A1 24 =253
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31589 0E 12 CD 13 11 CC 13 =496
31596 0D CD 01 08 CE 00 09 =446
31603 0C 14 09 C9 02 05 CC =645
31610 13 05 43 0. 11 43 14 =196
31617 0D 43 00 09 43 1D 05 =190
31624 1F 15 46 9E 1F 12 05 =334
31631 A1 00 11 43 9E 0D 11 =433
31638 46 9E 13 08 46 9E 1F =519
31645 11 43 9E 13 0D 43 9E =499
31652 0D 0D 43 9E 19 0A 05 =291
31659 A1 05 0A 04 A3 01 09 =353
31666 43 9E 1F 09 43 9E 0B =501
31673 05 43 9E 05 02 47 A0 =468
31680 11 01 04 A3 0C 15 46 =276
31687 9E 1F 02 05 A1 02 06 =365
31694 05 A1 0F 0. 04 A3 10 =365
31701 01 04 A3 02 0E 05 A1 =350
31708 1D 0E 05 A1 21 E0 00 =466
31715 15 CE 00 11 C4 0E 12 =472
31722 0D 13 11 CC 13 0D CD =682
31729 01 0D CD 00 09 CC 14 =452
31736 09 C9 02 05 CC 13 05 =445
31743 43 01 11 1F 15 46 9E =365
31750 1F 12 05 A1 00 11 43 =299
31757 9E 0D 11 46 9E 13 08 =448
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31771 0D 43 9E 0D 0D 43 9E =489
31778 19 0A 05 A1 05 0A 04 =220
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31792 43 9E 0B 05 43 9E 05 =471
31799 02 47 A0 11 01 04 A3 =418
31806 00 15 46 9E 1F 02 05 =287
31813 A1 02 06 05 A1 0F 01 =351
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31834 0B 0F 9C 0D 12 CF 11 =437
31841 7A 00 13 00 2C 5B 14 =296
31848 01 1E 0A 00 5B 14 01 =153
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31862 14 01 F2 7A 00 00 99 =538
31869 7A 00 13 03 2C 5B 08 =290
31876 01 14 03 00 5B 00 01 =129
31883 13 02 4A 5B 1F 01 18 =242
31890 0D 03 F2 7A 00 00 F5 =625
31897 7A 00 13 00 2C 5B 08 =287
31904 01 14 02 00 5B 11 01 =132
31911 13 01 4A 5B 15 01 18 =231
31918 0D 05 5D 7C 01 00 48 =313
31925 7A 00 13 00 2C 5B 14 =296
31932 01 1E 0D 00 5D 14 01 =154
31939 0E 06 4A 5B 14 01 12 =224
31946 0D 02 F2 7A 00 00 5B =472
31953 7B 02 13 04 2C 5B 0A =293
31960 01 19 03 00 5B 12 01 =139
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31974 11 06 5A 7C 01 00 99 =391
31981 7A 00 13 05 2C 5B 08 =292
31988 01 14 06 00 5B 00 01 =132
31995 13 06 4A 5B 1F 01 18 =246
32002 0D 03 F2 7A 00 00 5B =473
32009 7B 02 13 09 2C 5B 08 =299
32016 01 0C 05 00 5B 12 01 =128
32023 09 07 4A 5D 13 01 0B =214
32030 0C 06 5A 7C C1 00 E0 =457
32037 7B 02 13 08 2C 5B 08 =298
32044 01 0C 05 00 5B 12 01 =128
32051 09 07 4A 5B 13 01 06 =211
32058 09 06 5A 7C C1 00 F5 =475
32065 7A 16 0E 07 2C 5B 0F =315
32072 01 09 04 00 5B 10 01 =127
32079 09 03 4A 5B 15 01 0B =212
32086 0A 05 5D 7C C1 00 00 =233
32093 00 00 00 00 C0 00 00 =0
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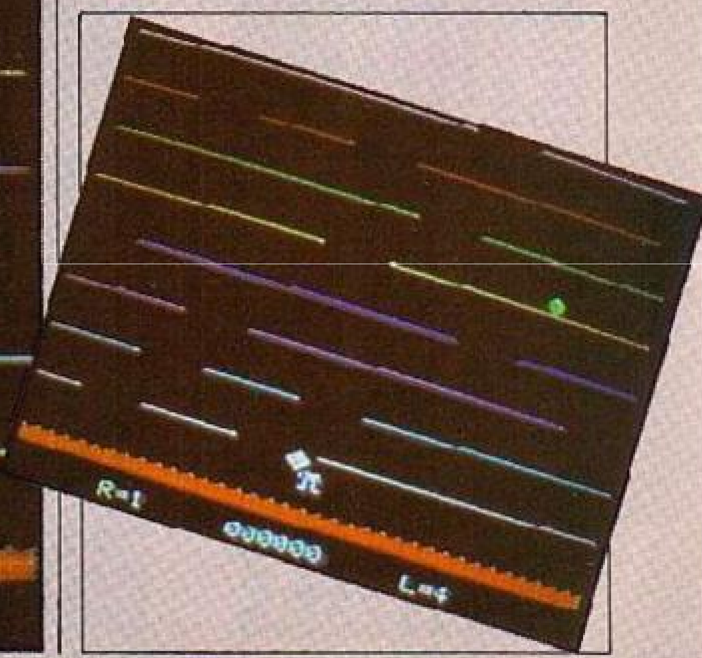
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0 PAPER 0:INK7:CLS:PRINT"Please wait..
.."
1 FOR F=£A000 TO 42916
2 READ A:POKE F.A
3 NEIT F
5 DA~A :62.0.214,100.208.26.181.108.20
1,32.208,12,169,:21,149,108.3
7.47
6 DA~A :60.149,100.24.144.8.169,32,149
,108.169,4.149,100,232,224,8,
208
7 DA~A 221.96,0,0.0,0,0.0,0.0,0,173,4.
3,41.63.56.201,40,176,3,105,5
.96
8 DA~A 233.35,96,0.0,0,0.0.0.0,0.0
9 DA~A :69.130,133,130,169,187,133,131
,165.108,133,132,32,231,160,1
69
10 DATA 250.133,:30,169,187,133,131,16
5,109,133,:32,32.202,160,169.
114
11 DATA 133,130.:69,188,133,131,165,11
0,133,132,32,231,160,169.234,
133,:30
12 DATA 169,188,:33,131,165,111,133,13
2.32.202.160.169.98,133,130.1
69,189
13 DATA 133,131,:65,112.133,132,32,231
,160.169,2:8,133.130,169,189.
133
14 DATA 13:,165,:12,133,132,32,202,160
,169.82,133,130,:69,190,133.1
31,165
15 DATA 114,133,:32,32,231,160,169,202
,133.130,169,190.133,131,165,
115,:33
16 DATA 132,76,202,160,0,0,0,0,00,0,0,
0,0,0,160,:,177,:30,136,145,1
30,200
17 DATA 200,192,36,208,245,165,132,136
,145.130,96,0,0,0,0,0,0,0,0,0
,0
18 DATA 160,34,177,130,200,145,130,136
,136,192.255,208.245.165.132.
200,:45
19 DATA 130,96,0,0,0,0,0,0,0,0,0,0,160
,:,177,130,201,122,208,10,170
,:69,32
20 DATA 145,130,138,136,145,130,200,20
0.192,36,208,235,136,56,165,1
30,233
2: DATA 120,133,128,165,131,233,0,133,
129,:77,128,201,122,208,6,145
,:30,169
22 DATA 32,145,128,96,0,0,160,34,177,1
30,201,122.208,10,170,169,32,
145,:30
23 DATA 138,200,145,130,136,136,192,25
5.208,235,200,56,165,130,233,
120,:33
~4 DATA 128,165,131,233,0,133,129.177,
128,20:,122,208,6,.45,130,169
.32,145
25 DATA 128,96,0,0.0,0,0,0,169,162,133
,130,169,:90.133,131.32,56.16
1,169,42
26 DATA 133,:30,169,190,133,131,32,4,1
61,169.178,133,:30.169,189,13
3,131
27 DATA 32,56,161,:69,58,133,130,169,1
89,133,13:,32,4.16:,169,194,1
33,130
28 DATA 169,:88,133,131,32,56,161,169,
74,133.130,169,:88.133,131,32
.4,161
29 DATA 169,210.133.130,169,187,133,13
1,32,56,161
31 DATA £E6,99,:69.32.141.197,190,96,0
,0,0,0.0,0,0.0
37 DATA £AD,0,2,£C9,180,£D0,3,£4C,0,16
2,£C9,172.£D0,3.£4C,1:4,162,£
C9,156
40 DATA £D0,3,£4C,228,162,£C9,188,£F0.
228,£4C,187,163
50 DATA 000,000,000,000,000,000,000,00
0,000,000
51 DATA 000,000,000,000,000,000,000,00
0,000,000
60 DATA £:8,£A~.124,£69,1,£85,126,£A5,
125,£69,0.£85,127,£A0.2,£B1.1
26,£C9.16
70 DATA £D0,13,£38.£A5,126,£E9,35,£85.
126,£A5,127,£E9.0,£85.127,£A9
.105
80 DATA £85.116.£A9,106,£85,117,£A5.12
0,£C9,0,£D0,14,£A2.11:,£86,:1
8,£E8
90 DATA £06,117.£A2,1,£86,120.£4C,128,
163.£C9,1.£D0,14,£A2,:07,£B6,
118,£E8
100 DATA £86.119,£A2,2,£86,:20,£4C,128
,163,SHOO~A2,109,£86,:18,£E8,
£86,119
~110 DATA £A2,0.£86,120,£4C,128,163
120 DATA 000,000,000,000,000,000,000,0
00,000,000
121 DATA 000,000,000,000,000,000,000,0
00,000,000
130 DATA £38,£A5,124,£E9,1,£85,126,£A5
,125,£E9,0,£85,:27,£A0,0.£B:,
126
140 DATA £C9.16.£D0.13.£:8.£A5.126.£69
,35,£85,126,£A5.127,£69,0,£85
,127
150 DATA £A9,97,£85.116.£A9,98.£85,117
,£A5,120,£C9,0,£D0,14,£A2,103
160 DATA £86,118,£E8,£86,119,£A2,1,£86
,120,£4C,128,163.£C9,1,£D0,14
170 DATA £A2,99.£86.118.£E8,£86,119,£A
2,2,£86,120,£4C,128,163,£A2,1
01
180 DATA £86.118.£E8,£86,119,£A2,0.£86
,120,£4C.128,163
190 DATA 000,000,000,000.000,000,000,0
00.000.000
19: DATA 000,000,000,000,000,000,000,0
00.000,000
200 DATA £A2,1:3,£86,116.£E8,£86,117.£
E8,£86,1:0,£E8,£86,1:9,£20,4.
164
20: DATA £A2,80,£20,:31,166
210 DATA £20,0.160,£20,72,160,£38,£A5.
124,£E9,40,£85,126,£A5,125,£E
9~0
220 DATA £85,127,£A2,117,£86,116,£E8,£
86.117,£E8,£86.118,£E8,£86,11
9
230 DATA £A0,0,£B1,126,£C9,32,£F0,3,£4
C,88,164.£C8,£B1,:26.£C9,32,£
F0.3-
240 DATA £4C,88,164,£20,149,163,£38,£A
5,124,£E9,40,£85,:26.£A5,125,
£E9,0
250 DATA £85.127,£A0.0,£B1,126,£C9.155
,£D0,3,£4C,:06.164,£C9,32,£F0
,3
260 DATA £4C,88,164,£C8,£B1,126,£C9,32
,£F0,3,£4C,88,:64.£20,149,163
,£38
270 DATA £A5,124,£E9.40,£85,126,£A5,12
5,£E9,0,£85.127,£A9,:,£85,123

280 DATA £A2,100,£20
290 DATA 13:,166,£4C.128,163,000,000,0
00.000,000
291 DATA 000,000,000.000,000
300 DATA £A0,40,£B1,:26.£C9,122,£D0.3,
£20,150,166.£C8,£B1,:26,£C9,1
22,£D0,3
310 DATA £20,150,:66.£20,223,:63,£20,3
7,164,£A5,126,£85.124,£A5,127
,£85,125
320 DATA £20,4.164,£60
330 DATA 000,000,000,000,000,0000,000,
000,000,000
331 DATA 000,000,000.000,000,0000,000,
000,000,000
340 DATA £A2,117,£86.116,£E8,£86,117.£
E8,£86,118,£E8,£86,119,£4C.4,
164
350 DATA 000,000,000.000,000,000,000,0
00,000,000
351 DATA 000,000,000,000,000,000,000,0
00,000,000
360 DATA £A9,32,£A0,0,£91,:24.£C8,£91,
124,£A0,40,£91.124,£C8,£91.12
4,£60
370 DATA 000,000,000,000,000,000,000,0
00,000,000
371 DATA 000,000,000,000,000,000,000,0
00,000,000
380 DATA £A5,116,£A0,0,£91.124,£C8,£A5
```

One small step for Ivan could be a major jump for an Oric. One step beyond with Matthias Gyllerup.

MA





```
,117,£91.124,£A0,40,£A5,118,£
91.124
390 DATA ~C8,£A5,119,£91,124,£60
400 DATA 000,000,000.000,000,000,000.0
00.000,000
410 DATA £A9,1.£8D,225,2,£A9,0,£8D,227
,2,£A9,3,£8D,229,2,£A9,10,£8D
,231,2
420 DATA £20,182,251.£A9,0,£8D,225,2,£
8D.227.2.£8D.229.2.£8D,231,2
430 DATA £20,182,251.£60
440 DATA 000,000,000.000,000,000,000,0
00,000,000
450 DATA £20,149,163.£A9,0,£85.116,£60
460 DATA 000,000,000.000,000,000,000,0
00,000,000
470 DATA£20.149,163,£A9.1,£85.116,£60
480 DATA 000,000,000,000,000,000,000,0
00,000,000
490 DATA £A5,99,£C9,0,£D0,1,£60,£A5,98
,£C9,0,£F0,1,£60,£A5,121,£85,
98,£C6,99
500 DATA £A9,122,£8D.210,187,£60
510 DATA 000,000,000,000,000,000,000,0
00,000,000
520 DATA £A0.40,£B1,124.£C9,122,£D0.3.
£20,150,166,£C8,£B1,124.£C9,1
22,£D0,3
525 DATA £20,150,166,£A0,80,£B1,124.£C
9,32
530 DATA £D0,31,£C8,£B1.124,£C9,32,£D0
.24,£20,237,164,£60,00,£D1.12
4
540 DATA £C9,123,£D0,13.£A5,123,£C9.0,
£D0,3,£4C,88,164,£A9,0,£85.12
3
550 DATA £A5,123,£C9,1,£D0.6,£20,42.16
5,£20,18,244,£A9,0,£85,123.£6
0
570 DATA £20,187,163,£18,£A5,124.£69,4
0,£85,126,£A5,125,£69,0,£85,1
27
580 DATA £20,149,163,£18,£A5,124.£69,4
0,£85,126,£A5,125,£65,0,£85,1
27
590 DATA £20,149,163,£18,£A5,124.£69.4
0,£85,126,£A5,125,£65,0,£85,1
27
600 DATA £A5,0,£85
610 DATA 122,£A2,100,£20,151,166,£4C,6
7,165,000
620 DATA £AC,5.£85,159,191.£A6,£E8.£E0
,58,£F0.5,£EA,£99,159,151.£60
,£A9,48
630 DATA £99,159,191,£8E,£D0,234,£60
640 DATA £20,150,166,£4C,128,163,000,0
00,000,000
650 DATA £48,£A5,97,£C9,1,£D0.7.£A9,2,
£85,97,£4C,154,165,£C9,2,£D0.
7,£A9,3
660 DATA £85,97,£4C,187,165,£C9,3,£D0.
7,£A9,4,£E5,97,£4C,222.165,£C
9,4,£D0,7
670 DATA £A9,5,£85,97,£4C,3.166,£C9,7,
£D0,7,£A9,6,£85,97,£4C,222,16
5,£C9,6
680 DATA £D0,7,£A9,7,£85,97.£4C.187,16
5,£A9,1,£85,97,£4C,154,165
690 DATA 000,£A5,0,£8D,208,183,£8D,209
,183,£8D,210,183,£8D,213,183
700 DATA £8D,214,183,£8D,215,183,£A9,1
2,£8D,211,183,£8D,212,183,£68
710 DATA £4C,3,236,000,£A9,0,£8D,208,1
83,£8D,209,183,£8D,214,183,£8
D,215,183
720 DATA £A9,12,£8D,210,183,£8D,213,18
3,£A9,30,£8D,211,183,£8D,212,
183,£68
730 DATA £4C,3,236,000,£A9,0,£8D,208,1
83,£8D,215,183,£A9,12,£8D,209
,183
740 DATA £8D,214,183,£A9,30,£8D,210,18
3,£8D,213,183,£A9,63,£8D,211,
183
750 DATA £8D,212,183,£68
750 DATA £4C,3,236,000,£A9,12,£8D,208,
183,£8D,215,183,£A9,30,£8D,20
9,183
770 DATA £8D,214,183,£A9,63,£8D,210,18
3,£8D,211,183,£8D,212,183,£8D
,213,183
780 DATA £68,£4C,3,236
790 DATA £E6,0,£A5,0,£C9,255,£D0,2,£E6
,0
800 DATA £20,205,161,£A5,123,£C9,1,£D0
,10,£A2,50,£A0,255,£88,£D0,25
3,£CA,£D0
801 DATA 248
802 DATA£20,0,160,£20,72,160,£A5,116,£
C9,0,£D0,1,£60,£C9,1,£D0,1
810 DATA £60,£20,112,161,£20,124,164,£
A5,99,£C9,0,£F0,2,£C6,98,£20,
160,164
820 DATA £A5,116,£C9,0,£D0,1,£60,£A2,8
0,£A0,255,£88,£D0,253,£CA,£D0
,248
830 DATA £4C,37,164
840 DATA 000,000,000,000,000,000,000,0
00,000,000
850 DATA £A0,255,£88,£D0,253,£CA,£D0,2
48,£60
860 DATA 000,000,000,000,000,000,000,0
00,000,000
870 DATA £A9,10,£85,0,£20,187,163,£EA,
99,£A2,32,£86,116,£86,117,£A2
,124
880 DATA £86,118,£E8,£86,119,£4C,4,164
890 DATA £A0,0,£89,189,166,£99,8,183,£
C8,£C0,232,£D0,245,£60
900 DATA 1,3,6,15,31,6,3,1,48,56,60,62
,38,12,24,48,3,5,9,3,2,6,4,28
,56,52,52
910 DATA 24,12,6,2,14,3,5,7,1,1,1,1,7,
56,52,52,48,48,48,48,48,15,3,
7,4,4,28
920 DATA 0,0,56,52,50,16,24,12,4,28,3,
7,15,31,25,12,6,3,32,48,24,60
,62,24,48
930 DATA 32,7,11,11,6,12,24,16,28,48,4
0,36,48,16,24,8,14,7,11,11,3,
3,3,3,3
940 DATA 48,40,36,32,32,32,32,36,7,11,
19,2,6,12,8,14,60,48,56,8,8,1
4,0,0,0,0
950 DATA 3,7,13,15,6,19,0,32,48,56,44,
60,24,50,9,7,3,9,13,15,9,56,3
6,56,48
960 DATA 36,44,60,36,7,1,3,7,13,15,6,3
,1,32,40,56,44,60,24,48,32,7,
11,11,2
970 DATA 2,2,2,14,56,52,52,16,16,16,16
,28,63,0,0,0,0,0,0,0,51,30,45
,63,45,33
971 DATA 63,30
980 DATA 33,55,63,63,63,63,63,63
990 DATA 0,0,0,1,33,63,33,63,0,0,12,30
,59,59,62,28
1900 R=1:L=5:SC=0:SC$="000000":POKE 12
1,252:POKE 98,0:POKE99,.
1910 CALL 42671
1920 POKE £26A,10
2000 CLS:POKE 0,0:POKE48038,32:POKE 48
039,32
2001 A$="77711122223334445556667771777
777"
2002 C=1
2003 FOR F=108 TO 115:POKEF,121:NEXTF
2299 FORF=48000TO49080STEP40:A=VAL(MID
$(A$,C,1)):POKEF,A:POKEF+1,16
2499 POKEF+39,16:C=C+1:NEXT F
2500 DOKE 124,48900
2510 DOKE 126,48900
2511 PLOT 15,25,SC$:PLOT 15,15,32
2519 FOR F=100 TO 107:POKE F,RND(1)*20
+5:NEXT F
2520 FOR F=108 TO 115:POKE F,121:NEXT
F
2521 PLOT 1,23,"((((((((((((((((((((((
(((((((((((((("
2522 FOR F=47963 TO 47999:POKE F,155:N
EXT F
2523 FOR F=48002 TO 48037:POKE F,121:N
EXT F
2524 CALL 41951:DOKE 124,48900:DOKE 12
6,48900
2525 FOR F=2 TO 20 STEP 3:PLOT 1,F,"yy
yyyyyyyyyyyyyyyyyyyyyyyyyyyyy
yyyyy"
2526 NEXT F:PLOT 27,25,"    "
2527 PLOT 8,25,STR$(R):PLOT 7,25,"R="
2528 PLOT27,25,STR$(L):PLOT26,25,"L="
2529 IF AA=0THENDOKE 553,42317
2530 POKE 0,0:CALL 42533:DOKE 553,6041
9
2531 IF PEEK(116)=0 THEN L=L-1:IF L=-1
 THEN GOTO 2700
2533 IF PEEK(116)=1 THENR=R+1:FOR F=1
TO 10*R:CALL 42282:NEXT F:L=L
+1
2534 IF PEEK(116)=1 THENPOKE99,R:OB=25
2/R:POKE98,0:POKE 121,OB:GOTO
 2600
2550 WAIT 100:GOTO 2520
2600 SC$=""
2605 FOR F=49056 TO 49061:SC$=SC$+CHR$
(PEEK(F)):NEXT F
2610 AA=INT(RND(1)*6)
2615 ON AAGOTO 2617,2619,2621,2623,262
5
2616 GOTO 2000
2617 POKE 47056,51:POKE 47057,30:POKE
47058,45:POKE 47059,63:POKE 4
7060,45
2618 POKE 47061,33:POKE 47062,63:POKE
47063,30:GOTO 2000
2619 POKE 47056,0:POKE 47057,0:POKE 47
058,63:POKE 47059,45:POKE 470
60,63
2620 POKE 47061,12:POKE 47062,12:POKE
47063,51:GOTO 2000
2621 POKE 47056,63:POKE 47057,45:POKE
47058,63:POKE 47059,12:POKE 4
7060,12
2622 POKE 47061,12:POKE 47062,12:POKE
47063,51:GOTO 2000
2623 POKE 47056,12:POKE 47057,30:POKE
47058,63:POKE 47059,45:POKE 4
7060,63
2624 POKE 47061,63:POKE 47062,51:POKE
47063,30:GOTO 2000
2625 POKE 47056,12:POKE 47057,30:POKE
47058,63:POKE 47059,45:POKE 4
7060,63
2626 POKE 47061,51:POKE 47062,30:POKE
47063,51:GOTO 2000
2700 PLOT 14,10,"GAME OVER"
2710 PLOT 12,11,"PRESS ANY KEY"
2720 GET A$:WAIT 300:GET A$:GOTO 1900
```

D JUMP

IVAN IS A character with long legs and a big head and the object of this game is simply to make him jump up eight platforms to the top of the screen. The screen is divided by horizontal lines and gaps appear in these lines at intervals. When a gap appears directly above Ivan, he is able to leap into the air and ascend a level.

If you fall down through a gap or run into a monster you will become temporarily stunned. But if you knock your head into something or fall down on the ground you will lose one of your six lives.

There are six different hazards — a flame, some monsters and Leggy — which roam the platform. Each completed screen adds a bonus, increases number of lives and adds new hazards.

Ivan is controlled from the keyboard with the Cursor keys.

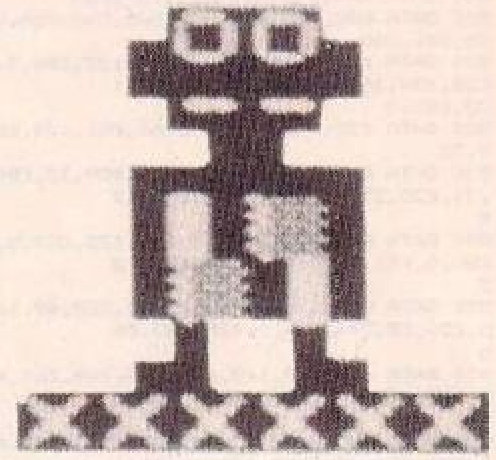
Cursor Left to make him move left;
Cursor Down to make him move right;
Cursor Up to make him jump;
Cursor Right to pause — you can not pause when you are stunned.

For those interested in machine code the main subroutines and their addresses are given below, in case you wish to disassemble them.

41032 — Move holes.
41328 — Move hazards.
41421 — Read keyboard and move Ivan.
42021 — Sound.
42221 — Fall down.
42282 — Score.
42533 — Main routine.
42648 — Draw stunned Ivan.
42317 — Interrupt routine that makes the flames burn.

BARREL BARRAGE

Miquel van Smoorenburg ushers in a scenario of simian mayhem, specially tailored for the Sinclair ZX-81.



THE AIM OF the game is to get the keys which are displayed on the top of the screen without losing a life. You lose a life if you get hit by a rolling barrel but you are able to jump over such obstacles and only three at most are present.

At the beginning of the game there is only one rolling barrel present. If you reach the top of the screen you can get a key. There are three keys at the start of the game. When there are two keys left there will be two rolling barrels and if only one key is left there are three rolling barrels. However, if you manage to get your hands on the last key you will get a bonus of 100 points. Then you start again, with three keys and one barrel, but with one difference — the speed increases. Scoring is as follows: you still start with five lives but this and the starting speed are adjustable — it is even possible to start off with 38 lives. The game has on-screen scoring and a high-score.

Jump over a barrel:	10 points
Grab a key:	50 points
Get the last key:	100 points

The code is kept as short as possible; that is why I made the high-score in Basic. For entering the code, you need a Rem statement with at least 640 characters. This may look a lot but it isn't if you follow the instructions.

Type in:

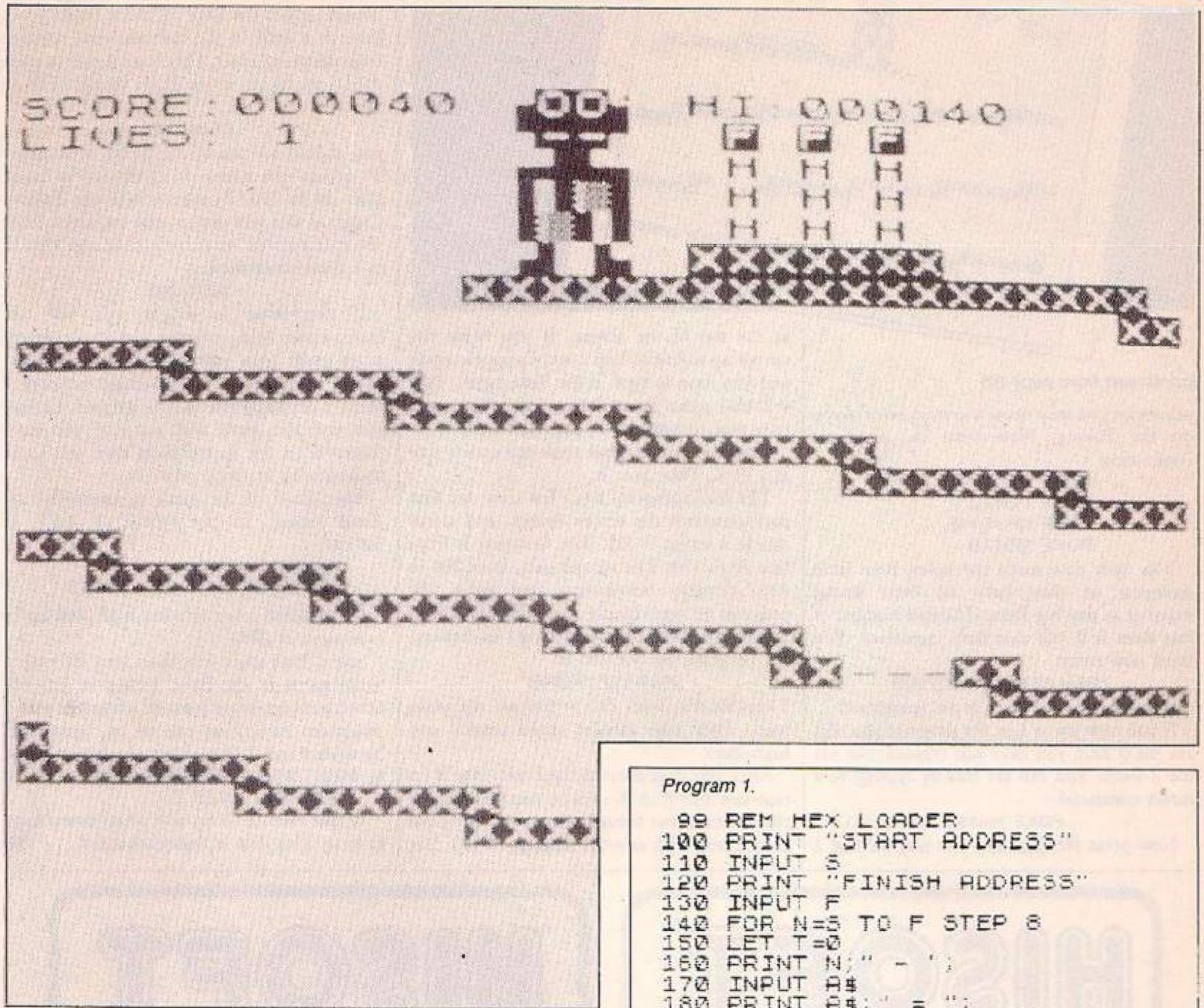
2 REM 0000 etc.

You must enter 87 characters after the Rem. Now edit this line some times, and when you have seven of these lines — 2 Rem to 8 Rem — you can enter 1 Rem with nothing following it

(continued on page 94)

Program 2. Machine code program.

```
16514: 7676C3DC41E5D5C5 = 1355    16834: 7E32774036172275 = 587
16522: CDBB02444D511420 = 672     16842: 40C93A7840FE0020 = 793
16530: 043E801804CD8D07 = 623     16850: 943E09327840ED52 = 772
16538: 7EC1D1E1C92A0C40 = 1072    16858: 18352A1040010500 = 292
16546: 019D000922794001 = 387     16866: 09ED5B0C40011903 = 442
16554: 580209227B40213C = 413     16874: ED80CD9F40CD2541 = 1149
16562: 40051E36002310F3 = 456     16882: 3E00322140CDBA40 = 664
16570: 3A21403C47213C40 = 443     16890: CD3241FE34287AFE = 1042
16578: 15005919545DC529 = 550     16898: 182376FEAB2808ED = 893
16586: 013240ED421AFE01 = 699     16906: 4B324008788120FB = 780
16594: 2805183CC110E6C9 = 770     16914: 18E33628E5CDBA42 = 1034
16602: 7E4F237E473E0002 = 501     16922: E101FF8F0B78B120 = 964
16610: 28030AFE76200103 = 464     16930: FB36801936AD3E00 = 747
16618: E52A7840ED423005 = 815     16938: 3277402A7B402275 = 613
16626: E13E001218DE1121 = 601     16946: 40CDBA420605C5CD = 934
16634: 006069197EFEBD23 = 835     16954: CD42C110F93A2140 = 884
16642: 06FE182802444D3E = 531     16962: 3C322140FE0320FD = 669
16650: 3402E171237018C4 = 759     16970: 060ACDCD4210FB2A = 801
16658: ED5FE60FFE0A20BC = 1051    16978: 0C400135000936FB = 364
16666: 3E0112ED43794071 = 691     16986: 232336AB232336FB = 590
16674: 237018B02A784022 = 610     16994: 3E003221402A3240 = 365
16682: 7540210000227740 = 431     17002: 01BC02ED42388601 = 665
16690: 1121002A7540CD87 = 613     17010: 580209223240C3F7 = 669
16698: 40FE1CCACC41FE21 = 1107    17018: 41F52A75403600CD = 776
16706: 2009237EFE76201D = 635     17026: BA42CDBA42E17EF5 = 1305
16714: 23181AFE21200928 = 456     17034: 060736177EC68077 = 661
16722: 7EFE7620102B180D = 626     17042: 1100201B7AB320FB = 660
16730: FE2320093A7740FE = 825     17050: 10F2F1772A0C4001 = 737
16738: 2D2A02ED52E519E5 = 881     17058: 2900097E3D77FE1C = 633
16746: 7EFE34CCCD42E17E = 1258    17066: 2005ED4B0C40C92A = 668
16754: E1112100FEBD280C = 770     17074: 7B40227540C3F741 = 909
16762: FE2D280D3A7840FE = 646     17082: 2A0C400618237EFE = 563
16770: 002006193E003278 = 295     17090: 76200310F8C9C680 = 944
16778: 403A7840FE012001 = 594     17098: 7718F22A0C400011 = 520
16786: 19FE0028043D3278 = 554     17106: 0A0019237EFE1CD8 = 694
16794: 407EFE002810FE2D = 799     17114: FE26D034FE252005 = 880
16802: 280CFE34C8FE18C3 = 1034    17122: 361C2B18EFC90000 = 589
16810: FEABC82A7540E52A = 1119    17130: 002A104001060009 = 138
16818: 75407EE1FE34C8E5 = 1267    17138: EB2A0C40011903ED = 619
16826: 2A75403A774077E1 = 808     17146: B0C9 = 377
```

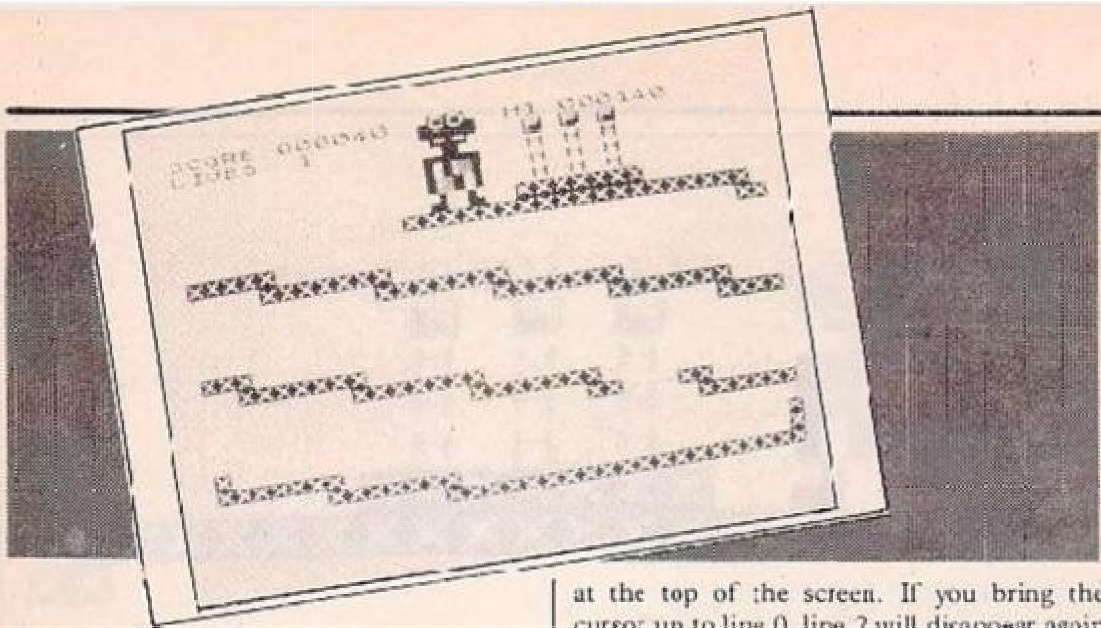


Program 1.

```
 99 REM HEX LOADER
100 PRINT "START ADDRESS"
110 INPUT S
120 PRINT "FINISH ADDRESS"
130 INPUT F
140 FOR N=S TO F STEP 8
150 LET T=0
160 PRINT N;" - ";
170 INPUT A$
180 PRINT A$;" = ";
190 INPUT TOT
200 PRINT TOT
210 LET Z=0
220 FOR K=1 TO LEN A$ STEP 2
230 LET C=(CODE A$(K)-28)*16+CO
DE A$(K+1)-28
240 LET T=T+C
250 POKE N+Z,C
260 LET Z=Z+1
270 NEXT K
280 IF TOT=T THEN GO TO 310
290 PRINT "ERROR - PLEASE INPUT
AGAIN"
300 GO TO 150
310 NEXT N
```

Program 3. The Basic program.

```
   5 REM --C-R-A-Z-Y--A-P-E----
   6 REM  MIQUEL VAN SMOORENBURG
   7 REM  20 BALJUWSTRAAT
   8 REM  TER-AAR P.CODE 2461SL
   9 REM  HOLLAND.
 200 PRINT "------ ++ CRAZY AP
E ++------"
 210 PRINT ,," SEND YOUR MAN UP
TO GET THE"," KEYS,AND JUMP OVER
 THE ROLLING"
 220 PRINT " BARRELS. AFTER YOU
HAVE COLLEC- TED 3 KEYS,YOU STAR
T WITH 3      KEYS AGAIN.HOWEVER,
THE SPEED"
 230 PRINT " HAS INCREASED...."
 240 PRINT ,," CONTROL YOUR MAN
WITH:"
 250 PRINT ,," 8. MOVE RIGHT",,"
 5. MOVE LEFT",," 0. JUMP",,"TO
CLIMB THE LADDER,PRESS 0","AND T
HEN HOLD DOWN 7."
 260 PRINT ,," AT THE BEGINNING
OF EACH GAME",," YOU MUST SELECT
 SPEED:0-15.",," 0 IS VERY FAST,A
ND 15 IS VERY"," SLOW."
 265 SAVE "KONG"
 270 PRINT AT 21,0;"   PLEASE
 SELECT SPEED      "
 280 POKE 16418,2
 290 INPUT SPEED
 295 IF SPEED>15 OR SPEED<0 THEN
 GOTO 290
 300 RAND 1000+100*SPEED
 310 LET L=6+USR 16516
 320 LET S$="      "
 330 FOR X=1 TO 6
 340 LET S$(X)=CHR$ PEEK (L+X)
 350 NEXT X
 360 IF VAL S$>VAL D$(23 TO 28)
THEN LET D$(23 TO 28)=S$
 365 PRINT AT 13,6;"**** GAME ",
,"  OVER ****"
 370 IF INKEY$<>"" THEN GOTO 370
 380 IF INKEY$="" THEN GOTO 380
 390 GOTO 270
 400 REM -C-R-A-Z-Y--A-P-E------
```



(continued from page 92)

otherwise you may cause a system error if you do the Poking. Now type in, as direct commands:

```
POKE 16511,141
POKE 16512,2
POKE 16515,118
POKE 16510,0
```

You have now made the seven Rem lines disappear as they have all been strung together as one big Rem. The line number of this Rem is 0, but that isn't important. You must now enter:

```
2 REM START PROGRAM
```

What follows the Rem is not important.

If you now try to List the program you will see the 0 Rem you have just created, but not the 2 Rem. You can see this by typing, as a direct command:

```
POKE 16419,2
```

Now press Newline and you will see line 2 at the top of the screen. If you bring the cursor up to line 0, line 2 will disappear again and you have to type in the Poke again. This will also occur if you delete line 2. You must now type in program 1, the hex loader.

Run the program and enter the code a line at a time. Then save it.

The Basic program has a few uses: the first part generates the screen layout, and stores this in a string — D$. The first part is from line 10 to 170. The second part, lines 200 to 265, displays instructions and saves the program on tape. Ignore the Rem before Save in line 265 — this was something I used to test the program. So line 265 is:

```
265 SAVE "KONG"
```

Then, finally, lines 270 to 390 are the main loop. They take care of speed control and high-score.

After you have entered the Basic, save it on tape and then Run. If all is correct you will see the screen layout being built and the program should stop with an error message: 9/170. If it doesn't, check the Basic. If there are mistakes there is a fault in the machine-code starting from address 17130. This is a routine to store the screen layout in the Basic variable D$, so by

```
PRINT D$
```

you should see the screen layout with many $'s around the screen. If all this works delete lines 10 to 170. Be sure not to use Run or Clear, as this will destroy the variables. Now set your recorder to record-mode and type in as a direct command:

```
GOTO 200
```

If everything is alright you will see instructions being printed and the program saves itself. Now you will be asked to select speed. You must enter a number between 1 and 15, anything else will be ignored. Choose one and the game will start. If you have followed all my instructions then the game should work properly now.

The speed of the game is controlled by Rand (value). In my listing, it works as follows:

```
290 INPUT SPEED
300 RAND 1000 + 130 * SPEED
```

So the Rand has a minimum of 1000 and a maximum of 2950.

Score, high-score and lives start off with a value given in the Basic listing in line 60. Score and high-score must be a number with a minimum zero, lives can be any characters between 0 and Z. Thus, it is possible to enter:

```
60 PRINT AT 0,0;"SCORE:095870","
HI:987320","LIVES: G"
```

In this example lives will count down from G to 0. This is in alphabetical order. ■

Is it a seagull? Is it a plane? No, it's the first of the robots in David Hodgett's Vic-20 game.

ROBOT ATTACK IS A game for the unexpanded Vic-20 and a joystick. It uses a fair amount of machine code to give it extra speed, and features a rapid fire, and a laser base with variable speed which can be set by the user.

The game comes in five parts, the first three of which are for the machine code, the fourth is for the graphics and the fifth part is the game itself.

The first four parts are all data and each program has its own check sum as, if you make a mistake in the machine code, it could cause the computer to crash. If there is a mistake you will get a Data Error. If this happens then re-check the data. After the five parts have been entered and checked you may



Program 1.

```
1 DATA 162,233,160,31,134,0,132,1,162,233,160,151
2 DATA 134,2,132,3,160,0,177,0,201,3,208,3
3 DATA 32,44,25,201,2,208,3,32,67,25,201,4
4 DATA 208,3,32,90,25,76,107,25,160,0,169,32
5 DATA 145,0.160,21,177,0,201,1,240,76,169,3
6 DATA 145,0,169,5,145,2,96,160,0,169,32,145
7 DATA 0,160,23,177,0,201,1,240,53,169,2.145
8 DATA 0.169,3,145,2,96,160,0,169,32.145,0
9 DATA 160,22,169,4,145,0,169,7,145,2,96,56
10 DATA 165,0,198,2,233,1,144,5,133,0,76,16
11 DATA 25,198,3,198,1,133,0,165,1.201,29,208
12 DATA 139,96,169,38,145,0,169,240,141,13,144,141
13 DATA 163,2,96,0,0,0,0,0,0,0,0,0
14 DATA 0,0,0,0,173,163,2,240,43,234,169,0
15 DATA 141,163,2.169,48,162,4,221,148,30,208,5
16 DATA 202,224,255,208,241,162,3,254,6,30,169,58
17 DATA 221,6,30,208,10,169,48,157,6,30,202,224
18 DATA 255,208,236,234,162,23.189,227,31,201,4,240
19 DATA 4,202,208,246,96,174.61,3,169,4,157,43
20 DATA 30,96,0,32,0,25,32,160.25,32,80,26
21 DATA 32,128,26,96,0,0,0,0,0,0,0,0
50 DATA 169,76,141,119,2,169,79,141,120,2,169,65
51 DATA 141,121,2,169,68,141,122,2,169,13,141,123
52 DATA 2,169,82,141,124,2,169,213,141,125,2,169
53 DATA 13,141,126,2,169,9,133,198,96,0,0,0
100 FORA=6400TO6651:READN:POKEA,N:T=T+N:NEXT
110 IFT<>23157THENPRINT"DATA ERROR" END
120 T=0:FORA=673TO720:READN:POKEA,N:T=T+N:NEXT
130 IFT<>4690THENPRINT"DATA ERROR":END
140 POKE35879,8:PRINT"J■":SYS673
```

Program 2.

```
1 DATF162,22,160,30,134,0,132,1,160,22,177,0
2 DATA 201,1,208,3,32,44,26,32,29,26,165,1
3 DFTA201,32,208,236,96,24,165,0,105,1,175,3
4 DATA133,0,96,230,1,133,0,96,160,22,169,32
5 DATA145,0,160,0,177,0,201,32,240,3,76,165
6 DATA26,169,1,145,0,96,169,38,145,0,169,240
7 DATA141,13,144,141,153,2,96,0,32,0,26,162
8 DATA22,169,7,157,227,151,157,227,31,202,208,245
9 DATA162,23,169,32,157,20,30,202,208,248,173,12
10 DATA144,240,3,206,12,144,173,13,144,240,3,206
11 DATA13,144,76,128,25,0,0,0,162,211,189,44
12 DATA30,201,33,176,16,202,208,246,162,255,189,255
13 DATA30,201,33,176,10,202,208,246,96,222,44,30
14 DATA76,137,26,222,255,30,76,149,26,201,2,240
15 DATA9,201,3,240,5,201,4,208,142,96,169,255
16 DATF141,163,2,76,66,26,0,0,0,0,0,0
17 DATA173,43,28,41,1,208,4,24,76,204,26,56
18 DATA110,43,28,110,44,28,110,51,28 110,52,28
19 DATA96,0,0,0
100 FORA=6656TO6873:READN:POKEA,N:T=T+N:NEXT
110 IFT<>21803THENPRINT"DATA ERROR":END
120 SYS673
```

Program 3

```
1 DATA169,0,141,19,145,169,127,141,34,145,169,5
2 DATA141,60,3,120,169,28,141,20,3,169,27,141
3 DATA21,3,88,96,206,60,3,240,3,76,192,27
4 DATA120,172,61,3,169,32,153,205,31,169,5,141
5 DATA60,3,169,16,44,17,145,208,3,32,130,27
6 DATA169,128,44,32,145,208,3,32,118,27,159,32
7 DATP44,17,145,208,3,32,152,27,172,61,3,185
8 DATA205.31,201,32,208,12,159,0,172,61,3,153
9 DPTA205.31,88,76,176,27,169,255,141,161,2,169
10 DATA0,172,61,3,153,205,31,76,192,27,173,61
11 DATA3,200,192,23,240,14,140,61,3,96,173,61
```

(continued on opposite page)

load and play the game. To do this hold down the Shift key and tap the Run/Stop key and, providing there are no data errors, all the programs will load automatically.

At the start of the game you will be confronted with an options page: F1 determines the speed of the laser base; F3 gives the fire rate and fire to start the game.

There are two kinds of alien — the robots which travel down the screen diagonally and the pods which are indestructible and fall from directly above you. When a pod reaches the bottom of the screen it warps back to the top and again falls from directly above you. The longer you last the more pods will be added. Each robot scores 10 points.

The time before another pod is added can be changed while on the options page by using F5. The lower the number the faster.

ROBOT ATTACK



(continued from opposite page)

```
12 DATA3,136,240,10,140,61,3,96,169,1,141,61
13 DATA3,96,169,22,141,61,3,96,206,63,3,208
14 DATA18,169,6,141,63,3,172,61,3,169,1,153
15 DATA183,31,169,240,141,12,144,96,172,61,3,169
16 DATA3,153,205,151,76,192,27,0,0,0,0,0
17 DATA172,61,3,185,205,31,201,0,208,156,76,191
18 DATA234,0,0,0,120,162,191,160,234,142,20,3
19 DATA140,21,3,88,96,0,0
100 FORA=6912TO7134:READN:POKEA,N:T=T+N:NEXT
110 IFT<>21101THENPRINT"DATA ERROR"END
120 SYS673
```

Program 4.

```
1 DATA 24,24,24,36,36,189,231,189,24,24,24,24
2 DATA 24,24,24,24,153,219,36,60,36,60,66,195
3 DATA 153,219,36,60,36,60,66,195,24,60,60,126
4 DATA 126,60,60,24,1,14,63,51,51,63,14,1
5 DATA 128,112,252,51,51,252,112,128,0,255,255,255
6 DATA 0,0,0,0,0,0,0,0,0,0,0,0
7 REM
8 DATA 0,0,0,0,0,0,0,0,0,66,36,0
9 DATA 0,36,66,0,0,0,0,0,24,24,24,24
10 DATA 0,0,0,24,36,231,36,66,0,0,0,255
11 DATA 24,36,36,66,0,129,102,24,255,36,36,66
12 DATA 36,36,24,255,24,36,36,66,0,0,0,0
13 REM
14 DATA 56,108,206,214,214,230,108,56,24,56,120,24
15 DATA 24,24,126,126,56,108,68,12,24,48,126,126
16 DATA 124,126,6,62,62,6,126,124,28,60,108,204
17 DATA 255,255,12,12,254,254,128,252,254,2,254,252
18 DATA 6,12,24,56,124,198,198,124,252,254,14,28
19 DATA 56,112,224,192,124,254,130,254,254,130,254,124
20 DATA 124,198,198,126,28,56,112,224,0,0,0,0
90 FORA=0TO500:POKE7168+A,PEEK(32768+A):NEXT
100 FORA=7168TO7240:READN:POKEA,N:T=T+N:NEXT
110 IFT<>8244THENPRINT"DATA ERROR":END
120 T=0:FORA=7425TO7480:READN:POKEA,N:T=T+N:NEXT
130 IFT<>2271THENPRINT"DATA ERROR":END
140 T=0:FORA=7549TO7634:READN:POKEA,N:T=T+N:NEXT
150 IFT<>5968THENPRINT"DATA ERROR":END
200 SYS673
```

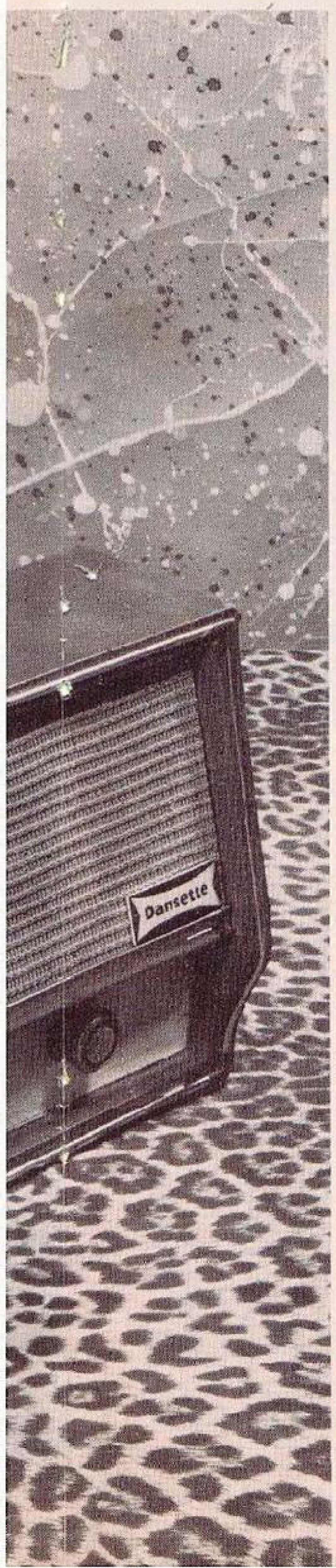
Program 5.

```
0 POKE56,24:POKE52,24
1 LB=2:FR=2:PA=4
10 POKE36869,255:GOSUB500:POKE36879,8
11 POKE6958,LB+3:POKE7070,FR+4
20 POKE829,11:POKE831,1:TI$="000000"
30 PRINT"SCORE: 000000":LV=3
40 SYS6912:SYS6631:POKE573,0:X=0:Y=0:POKE36878,15
50 FORA=0TO5:SYS5631:IFPEEK(673)=255THEN100
60 NEXT:IFVAL(TI$)>PATHENPOKE7720,4:TI$="000000"
70 POKE7724+RND(1)*22,(RND(1)*2)+2
80 GOTO50
100 SYS7121:POKE36877,129:POKE36876,0
110 S=PEEK(829):FORA=15TO0STEP-1:POKE36878,F:POKE8141+S+X,30
120 POKE8141+S+Y,30:X=X-23:Y=Y-21:SYS6631:POKE36877,129:FORD=0TO20:NEXT:NEXT
130 FORA=0TO10:SYS6784:FORS=0TO50:NEXT:NEXT
135 LV=LV-1:IFLV>0THEN40
140 FORS=0TO18:SYS6848:NEXT:PRINT"GAME OVER"
150 FORA=15TO0STEP-1:POKE36878,A
160 FORS=0TO100STEP10:POKE36874,130+S:POKE36877,130+S
170 NEXT:NEXT:POKE36874,0:POKE36877,0:RUN
500 POKE36879,10:PRINT""
510 PRINT"ROBOT ATTACK(C)1984 BY D.HODGETTS"
550 PRINT"PRESS FIRE TO PLAY"
560 SYS6848:IF(PEEK(37151)AND32)=0THENRETURN
570 GOSUB600:FORS=0TO70:NEXT:GOTO560
600 GETA$:IFA$=""THENLB=LB+1:IFLB>5THENLB=0
610 IFA$=""THENFR=FR+1:IFFR>5THENFR=0
620 IFA$=""THENPA=PA+1:IFPA>5THENPA=0
630 PRINT"LASER BASE SPEED";LB
640 PRINT"FIRE RATE";FR
650 PRINT"TIME TO PODS ARRIVAL";PA
660 RETURN
```

Amazing how played out some things be



s become. Will you think the same of your micro in 6 months' time?



Remember the days when every record player was gifted with a needle instead of a stylus. 45's were "in," 78's were "out."

Before the days of hi-fi and laser discs. When a graphic equaliser was a breakthrough on the football pitch instead of in music technology.

Look at a record player now and it's a museum piece.

It's like that with micros too. The machine you thought would give endless hours of fun and interest often becomes a five minute wonder. Played out within months. Or so you thought.

But imagine communicating with other micro users on a nationwide mainframe system. Updating yourself daily with the very latest computer news and reviews. Paging a special Bulletin Board. Feasting from *Prestel's vast menu. Even downloading a choice of software *absolutely free.*

In fact, imagine 30,000 pages at your fingertips and you've imagined what it's like to be on line with the Micronet 800 system.

For Just £13 a quarter (and, for most of you, a local telephone call whenever you want to connect up) you could subscribe to the Micronet system.

The only extra you need to connect up is a modem unit. Which is a small enough outlay for what it buys.

Micronet's features are almost limitless and constantly updating so why not see it in action at John Lewis stores, selected W. H. Smith shops and Spectrum UK dealers.

Or fill in the coupon for our brochure.

You'll find you won't want to play on anything else.



Please send me the full facts about Micronet 800.

Name__________

Make/Model of Micro__________

Address__________

Telephone__________

MICRONET 800, Durrant House, 8 Herbal Hill, London EC1R 5EJ. Telephone 01-278 3143. YC.8

MICRONET 800, Durrant House, 8 Herbal Hill, London EC1R 5EJ. Telephone 01-278 3143.

*Prestel and the Prestel symbol are trademarks of British Telecommunications.

Making the most of your micro.

EVENTUALLY, AFTER many months of disappointment, decent arcade games are appearing on the Dragon market, most often under the title Microdeal. However, I had never been able to get my hands on a Hunchback type game. After seeing my friend's version on a CBM-64, I just couldn't wait for Mr Kalish to relieve my pangs.

So I sat down and threw a version together. Realising the potential of the game I became more interested in it and began designing a brickwall and animated graphics. When I had finished it was difficult to stop playing.

The idea of the game is to control your small blue knight along the side of the castle wall in search of the legendary 16th bell.

Your Queen has equipped you only with a blessing and the cape of unreal strength and agility. You must leap the dangerous fissures where knights hide waiting to spear you with their gruesome pikes while avoiding the flaming balls of oil and the deadly poison tipped arrows which will pierce your heart!

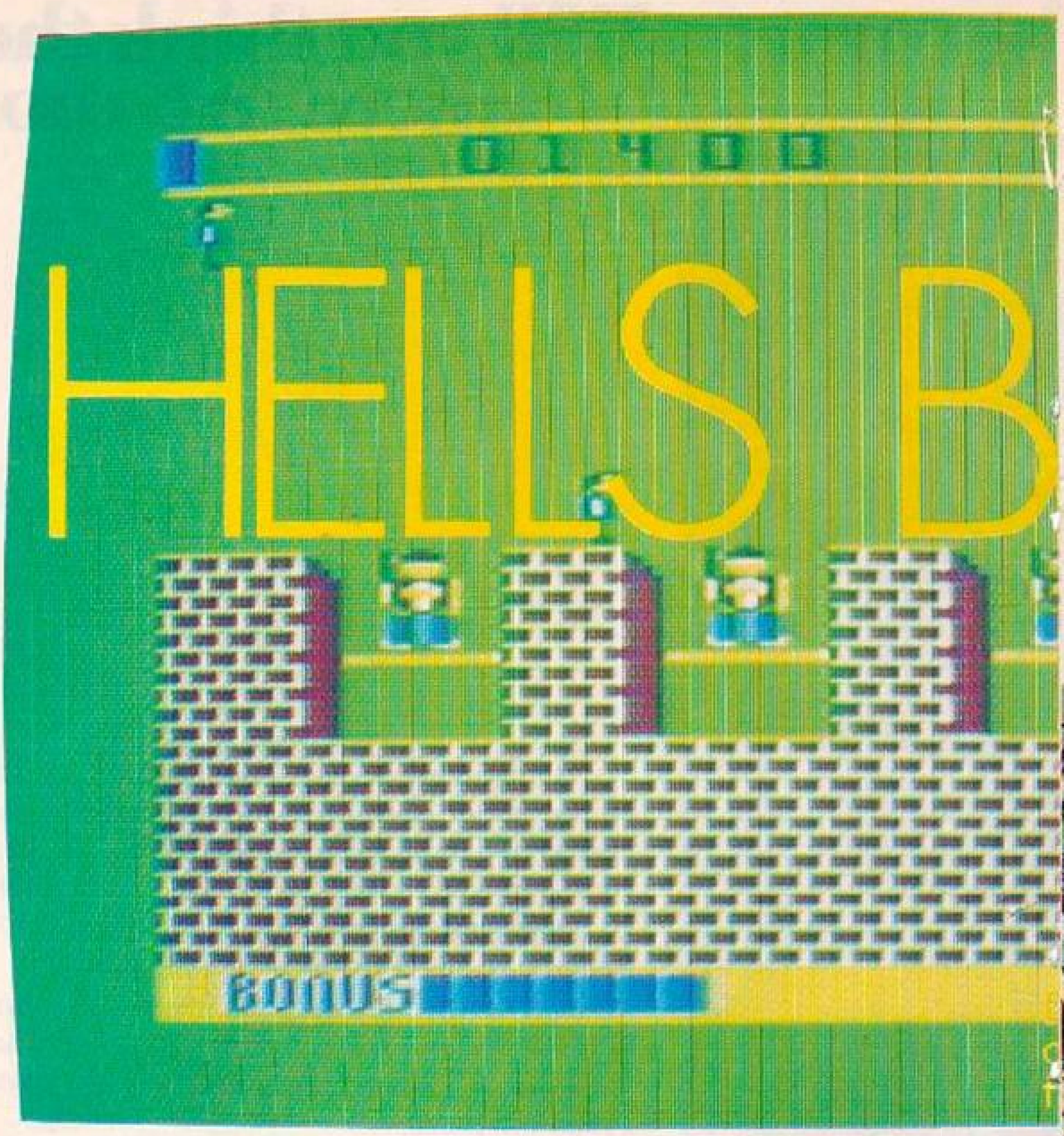
Back to reality, to type the game in first type in the hex loader — listing 1 — and then run using the data from the listing provided. The data is checked after each line so there should be no mistakes. However, save the game before running just in case.

To save the game type:

CSAVEM CASTLE',&H5400,&H616A,21555

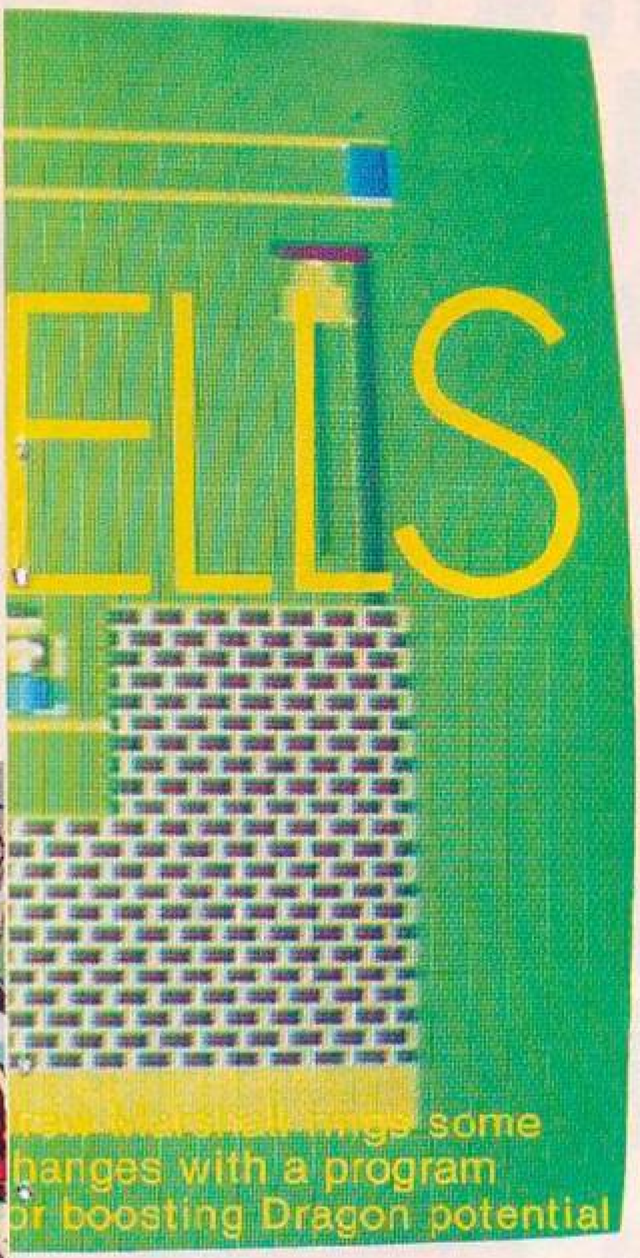
Once you have typed it in and saved it can be run using EXEC21555. However, once it has been loaded EXEC will do fine.

If there are any problems write to me at: 12 Yonge Close, Radcliffe-on-Trent, Nottingham NG12 2EE. Enclose a stamped addressed envelope and your problem. I will be happy to help out with any difficulties you meet.

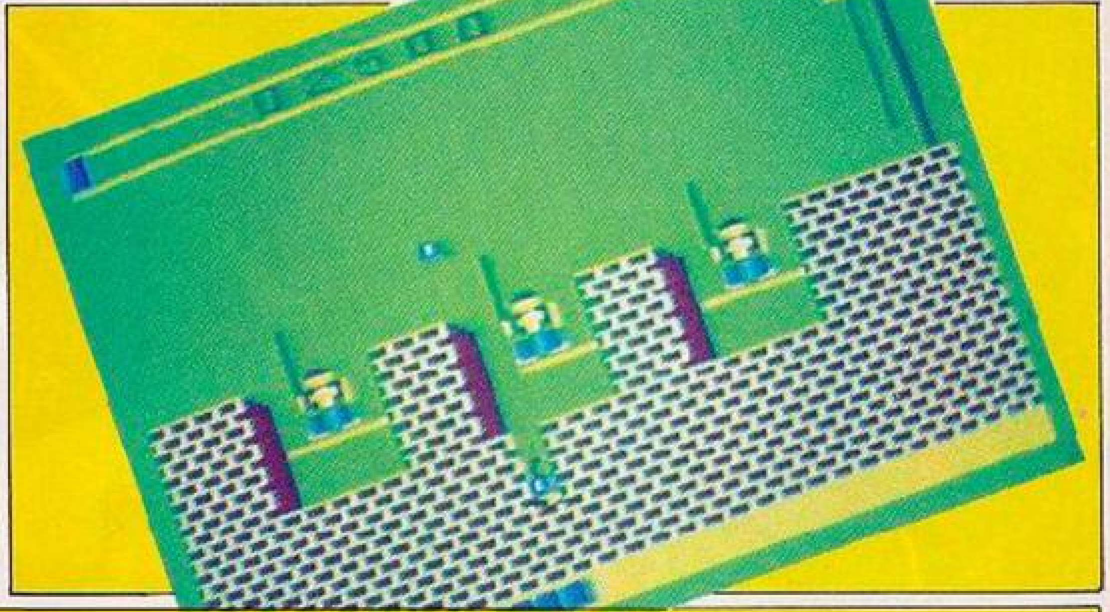


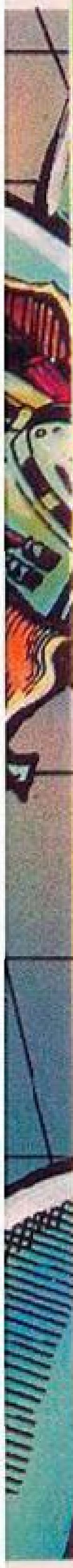


```
21504 : 00,00,00,00,01,00,FF,00,100
21512 : FF,14,C2,00,FF,0E,6F,0F,360
21520 : E2,0E,79,00,FF,00,FF,00,367
21528 : FF,00,FF,00,10,00,03,02,213
21536 : C0,00,01,00,00,01,00,20,22
21544 : C0,00,00,00,00,1D,B0,06,D3
21552 : 68,09,73,BD,5D,59,BD,5F,373
21560 : C4,BD,5A,DD,BD,5A,13,7F,3A1
21568 : C1,12,7F,01,13,BD,5A,03,1C0
21576 : BD,5B,FD,BD,54,9A,BD,54,4D1
21584 : E3,B6,54,15,10,26,04,05,231
21592 : BD,56,EC,BD,57,5D,BD,55,482
21600 : 4C,BD,55,21,10,BE,54,1C,2ED
21608 : 31,3F,2A,FC,7E,54,45,39,2E2
21616 : EE,54,28,30,86,A6,84,B7,3A1
21624 : 54,2D,1F,98,BB,54,2D,A7,31B
21632 : B4,BE,54,2C,A6,84,81,09,346
21640 : 22,08,30,1F,8C,54,28,26,1A7
21648 : F3,39,6C,1F,80,0A,A7,84,36C
21656 : 20,F0,BE,54,28,36,10,A6,306
21664 : 84,C6,08,3D,1F,70,10,BE,314
21672 : 54,2F,BE,60,3F,30,86,C6,32C
21680 : C8,A6,80,A7,A4,31,A8,20,372
21688 : 5A,26,F6,BE,54,2F,30,02,2E9
21696 : BF,54,2F,37,10,30,01,8C,246
21704 : 54,2D,26,01,BE,06,68,BF,333
21712 : 54,2F,39,FC,54,31,81,01,2EF
21720 : 10,27,02,2F,C1,00,27,06,156
21728 : C0,05,FD,54,31,39,C6,FA,440
21736 : 4A,FD,54,31,8E,1C,C7,C6,403
21744 : 55,86,14,E7,80,4A,26,FB,3C1
21752 : 30,0C,8C,1D,C7,23,F2,B6,377
21760 : 54,31,8E,1C,C7,C6,A8,36,39A
21768 : 10,31,86,10,BF,54,2D,E7,2FE
21776 : 80,BC,54,2D,26,F9,37,10,323
21784 : 30,88,20,3C,1D,C7,26,E7,355
21792 : 39,B6,54,22,81,02,27,1B,22A
21800 : BE,54,09,10,8E,5F,6F,C6,34D
21808 : 07,5A,10,27,07,EB,A6,A0,2D0
21816 : A1,84,10,26,01,CD,30,88,2E1
21824 : 20,20,EE,BE,54,09,10,8E,2E7
21832 : 5F,E6,20,E3,B6,54,04,27,37D
21840 : 25,C6,08,86,06,BE,54,0F,2A0
21848 : 8C,0F,E0,10,27,00,DF,1C,2AD
21856 : FE,69,84,69,1F,30,88,20,34B
21864 : 4A,26,F4,5A,26,E5,BE,54,3DB
21872 : 0F,30,1F,BF,54,0F,B6,54,28A
21880 : 02,27,25,C6,08,86,06,BE,256
21888 : 54,11,8C,0E,60,10,27,00,196
21896 : C6,1C,FE,69,84,69,1F,30,335
21904 : 88,20,4A,26,F4,5A,26,E5,371
21912 : BE,54,11,30,1F,BF,54,11,296
21920 : B6,54,03,27,25,C6,08,86,2AD
21928 : 05,BE,54,0D,8C,0E,60,10,22E
21936 : 27,00,AD,1C,FE,69,84,69,344
21944 : 1F,30,88,20,4A,26,F4,5A,285
21952 : 26,E5,BE,54,0D,30,1F,BF,338
21960 : 54,0D,B6,54,05,27,25,C6,202
21968 : 08,86,05,BE,54,0B,8C,0F,24B
21976 : E0,10,27,00,94,1C,FE,69,32E
21984 : 84,69,1F,30,88,20,4A,26,254
21992 : F4,5A,26,E5,BE,54,0B,30,3A6
22000 : 1F,BF,54,0B,B6,54,17,27,285
22008 : 25,C6,08,86,06,BE,54,1A,2AB
22016 : 8C,0F,FE,10,27,00,78,1C,267
22024 : FE,66,84,66,01,30,88,20,327
22032 : 4A,26,F4,5A,26,E5,BE,54,3DB
22040 : 1A,30,01,BF,54,1A,B6,54,282
22048 : 01,81,02,10,26,06,FA,BE,278
22056 : 01,12,8C,00,32,23,64,8C,1E4
22064 : 00,4B,10,23,00,82,8C,00,18C
22072 : 82,10,23,00,A8,39,86,08,224
22080 : BE,54,0F,BD,61,16,8E,0F,2F2
22088 : FF,BF,54,0F,7E,55,76,86,3F0
22096 : 08,BE,54,11,BD,61,16,8E,2ED
22104 : 0E,7F,BF,54,11,7E,55,A0,324
22112 : 86,05,BE,54,0D,BD,61,16,20E
22120 : 8E,0E,7F,BF,54,0D,7E,55,30E
22128 : CA,86,05,BE,54,0B,BD,61,390
22136 : 16,8E,0F,FF,BF,54,0B,7E,34E
22144 : 55,F4,86,08,BE,54,1A,BD,3C0
22152 : 61,16,8E,0F,E0,BF,54,1A,321
22160 : 7E,56,1E,7F,54,23,8E,0F,285
22168 : A6,BD,56,A9,8E,0F,AE,BD,46A
22176 : 56,A9,8E,0F,B6,BD,56,A9,40C
22184 : 39,C6,16,86,C0,AA,84,A7,430
22192 : 84,30,88,20,5A,26,F4,39,309
22200 : 8E,0F,A6,BD,56,D0,8E,0F,3C3
22208 : AE,BD,56,D0,8E,0F,B6,BD,4A1
22216 : 56,D0,86,01,B7,54,23,39,314
22224 : B6,54,23,10,26,06,4A,4F,202
22232 : C6,0F,A7,84,30,88,20,5A,332
22240 : C1,00,26,F6,39,7F,01,12,2AE
22248 : 7F,01,13,39,BE,54,09,A6,28D
22256 : 89,02,20,81,FD,10,26,00,25F
22264 : 12,A6,84,81,3F,10,27,06,239
22272 : 20,81,FC,10,27,06,1A,7E,272
22280 : 57,08,39,8E,00,A0,BF,54,2DC
22288 : 26,BD,61,39,8E,00,45,BF,30F
22296 : 54,26,BD,61,39,C6,50,BD,3A4
22304 : 5C,EE,8E,00,20,BF,54,26,331
22312 : BD,61,39,BE,54,09,30,88,32A
22320 : 20,4F,A7,83,E0,BF,54,09,39A
22328 : 5A,26,E4,10,8E,FF,FF,31,431
22336 : 3F,26,FC,B6,54,1F,4A,B7,38A
22344 : 54,1E,81,00,22,06,BD,5D,235
22352 : A1,16,FC,E2,8E,0F,82,BF,473
22360 : 54,09,16,FC,DC,86,FF,BE,45E
22368 : 01,50,A7,80,8C,01,60,26,28E
22376 : F9,BD,80,06,81,5A,27,4E,38C
22384 : 81,58,27,00,81,0C,10,27,1D1
22392 : 00,D1,01,00,10,27,02,26,1DE
22400 : 39,B6,54,25,81,01,10,27,221
22408 : 02,61,86,01,B7,54,25,37,2D1
22416 : 54,22,B6,08,BE,54,09,C6,2E5
22424 : 10,66,84,66,01,30,88,20,239
22432 : 5A,26,F6,4A,81,00,26,EC,353
22440 : BE,54,09,30,01,BF,54,09,26E
22448 : 8E,5C,59,BE,54,09,8C,0F,328
22456 : 9E,10,27,00,46,39,BE,54,265
22464 : 09,8C,0F,80,10,23,05,59,185
22472 : B6,54,25,81,01,10,27,02,1EA
22480 : 26,86,01,B7,54,25,86,02,265
22488 : B7,54,22,BE,54,09,BD,5D,362
22496 : 2E,86,08,BE,54,09,C6,10,2AC
22504 : 69,84,69,1F,30,88,20,5A,2A7
22512 : 26,F6,4A,81,00,26,EC,8E,3B7
22520 : 54,09,30,1F,BF,54,09,BD,285
22528 : 5E,22,39,7C,54,00,B6,54,292
22536 : 0C,81,0D,22,1F,8E,0F,82,1EE
22544 : BF,54,09,86,02,F6,54,31,31F
22552 : C1,09,22,0C,BD,54,70,CC,345
```




```
10 INPUT"START ADDRESS";SA
20 PRINT SA;": ";
25 REM INPUT THE ENTIRE LINE AFTER THE ADDRESS
26 REM INCLUDING COMMAS AND CHECKSUM
27 REM PRESS BREAK TO STOP
30 LINEINPUTA$
40 IFLEN(A$)<25 THEN PRINT "TOO SHORT":GOTO 20
50 FOR I=1 TO 8
60 B$=LEFT$(A$,2):B=VAL("&H"+B$)
70 T=T+B
80 POKE SA,B:SA=SA+1
90 A$=RIGHT$(A$,LEN(A$)-3)
100 NEXT
110 IF T<>VAL("&H"+A$) THEN PRINT"ERROR:STOP
120 T=0:GOTO 20
```





```
22560 : 0A,05,FD,54,31,BD,54,39,2DB
22568 : C6,09,20,F0,8E,00,7F,BF,3AB
22576 : 54,26,E6,0F,BD,61,39,4A,2B0
22584 : 26,FA,7F,54,00,BE,54,1C,321
22592 : 8C,00,C0,27,CB,30,89,FE,332
22600 : D4,20,C2,8E,00,30,BF,54,387
22608 : 26,BD,61,39,86,01,B7,54,30F
22616 : 15,7F,54,21,39,86,01,B7,280
22624 : 54,25,B6,54,22,81,02,10,238
22632 : 27,00,A3,81,03,10,27,01,186
22640 : 3F,B6,54,21,81,00,27,1B,22D
22648 : 81,01,27,34,81,02,27,13,199
22656 : 81,07,27,61,81,08,27,28,1E8
22664 : 81,09,27,59,81,0A,27,70,22C
22672 : 7E,58,B0,C6,07,BE,54,09,36E
22680 : 30,88,F0,BF,54,09,86,00,33A
22688 : A7,89,02,00,3D,5C,59,5A,2FE
22696 : 26,EB,7C,54,21,7E,54,5E,332
22704 : 1C,FE,BE,54,09,C6,08,A6,3A9
22712 : 01,10,26,FE,4E,A6,89,02,2B4
22720 : 00,10,26,FE,46,86,10,BE,2CE
22728 : 54,09,66,84,66,01,30,88,266
22736 : 20,4A,26,F6,5A,26,EE,7C,370
22744 : 54,21,BE,54,09,30,01,BF,280
22752 : 54,09,7E,54,5E,C6,07,BE,318
22760 : 54,09,30,88,20,BF,54,09,251
22768 : 4F,A7,88,E0,BD,5C,59,5A,42A
22776 : 26,ED,7C,54,21,7E,54,5E,334
22784 : 7F,54,15,86,01,B7,54,22,29C
22792 : 7F,54,21,7E,54,5E,B6,54,32E
22800 : 21,81,00,27,1B,81,01,27,18D
22808 : 34,81,02,27,13,81,07,27,1A0
22816 : 61,81,08,27,28,81,09,27,1FA
22824 : 59,81,0A,27,70,7E,59,4D,29F
22832 : C6,07,BE,54,09,30,88,E0,380
22840 : EF,54,09,86,00,A7,89,02,2D4
22848 : C0,BD,5D,22,5A,26,EB,7C,323
22856 : 54,21,7E,54,5E,1C,FE,BE,37D
22864 : 54,09,C6,08,A6,1F,10,26,226
22872 : FD,81,A6,89,01,FE,10,26,412
22880 : FD,A9,86,10,BE,54,09,69,3C0
22888 : 84,69,1F,30,88,20,4A,26,254
22896 : F6,5A,26,EE,7C,54,21,BE,413
22904 : 54,09,30,1F,BF,54,09,7E,246
22912 : 54,5E,C6,07,BE,54,09,30,2CA
22920 : 88,20,BF,54,09,4F,A7,88,342
22928 : E0,BD,5D,22,5A,26,ED,7C,405
22936 : 54,21,7E,54,5E,7F,54,15,23D
22944 : 7F,54,21,7E,54,5E,86,01,2AB
22952 : B7,54,15,86,03,B7,54,22,206
22960 : B6,54,21,81,00,10,27,FE,2E1
22968 : DA,81,01,10,27,FE,D4,81,3E6
22976 : 02,10,27,FE,CE,81,03,27,290
22984 : 1C,81,04,27,18,81,05,10,176
22992 : 27,FF,12,81,06,10,27,FF,2F5
23000 : 0C,81,07,10,27,FF,06,81,251
23008 : 00,10,27,FF,1D,7C,54,21,24A
23016 : 7E,54,5E,7C,54,25,86,01,24C
23024 : B7,54,22,BD,5C,64,39,7C,33F
23032 : 54,25,86,02,B7,54,22,BD,2EB
23040 : 5D,2D,39,BD,5C,6F,BD,5C,364
23048 : 81,BD,5C,93,BD,5C,C9,BD,43C
23056 : 5C,AF,39,BD,5C,59,86,01,33D
23064 : B7,54,22,BE,0A,05,BF,54,20D
23072 : 31,7F,54,17,7F,54,04,7F,271
23080 : 54,02,7F,54,05,7F,54,03,204
23088 : 7F,54,01,7F,54,15,7F,54,23F
23096 : 21,B6,54,00,8E,6C,C2,81,35C
23104 : 00,27,05,30,06,4A,26,FB,13D
23112 : A6,84,81,01,26,0E,10,BE,27B
23120 : 0E,79,10,BF,54,11,B7,54,226
23128 : 02,A6,01,81,01,26,68,10,13C
23136 : BE,0F,FF,B7,54,04,10,BF,37A
23144 : 54,0F,A6,02,81,01,26,08,1BE
23152 : 10,BE,0F,EA,B7,54,05,10,287
23160 : BF,54,0B,A6,03,81,01,26,26F
23168 : 0B,10,BE,0F,77,10,BF,54,24C
23176 : 0D,B7,54,03,A6,05,81,01,248
23184 : 26,37,86,02,B7,54,01,BE,27F
23192 : 11,86,10,8E,5F,B2,EC,A1,3D3
23200 : ED,84,30,88,20,1C,83,00,20C
23208 : 00,26,F3,CC,55,55,ED,1F,39B
23216 : ED,01,ED,88,1F,ED,88,21,418
23224 : DC,14,46,26,0C,BE,11,8E,245
23232 : BD,5A,9A,BE,11,96,BD,5A,3FD
23240 : 9A,39,81,02,26,9C,86,01,29F
23248 : B7,54,17,10,8E,0F,E0,10,2BF
23256 : BF,54,1A,20,8D,BD,61,2D,325
23264 : 86,54,00,8E,60,C2,81,00,33B
23272 : 27,05,30,06,4A,26,FB,A6,273
23280 : 04,81,01,10,27,00,94,8E,13F
23288 : 11,80,C6,08,86,10,BD,5C,311
23296 : 42,30,02,4A,26,F8,30,89,295
23304 : 00,F0,5A,26,FF,86,55,8F,38A
23312 : 06,00,A7,84,A7,89,01,80,2E2
23320 : 30,01,8C,06,40,25,F3,86,241
23328 : AA,8E,06,20,A7,84,A7,88,398
23336 : 1F,30,88,20,8C,07,60,23,20D
23344 : F3,8E,1C,A0,86,55,A7,80,43F
23352 : 8C,1E,00,26,F9,1C,BE,60,237
23360 : DF,0C,1C,C2,36,10,A6,A0,387
23368 : 81,00,27,07,A7,84,30,88,292
23376 : 20,20,F3,37,10,30,01,8C,237
23384 : 1C,C7,26,E8,B6,54,1E,4A,363
23392 : B7,54,1F,10,27,01,BA,BE,2DA
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23408 : BF,54,09,BD,5C,59,B6,54,398
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23456 : A7,03,A7,04,30,88,20,8C,289
23464 : 16,84,25,EE,31,28,10,8C,2A2
23472 : 11,9C,25,E3,86,CC,8E,11,39A
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23504 : 8E,11,C4,BD,5B,B9,88,10,3CF
23512 : 8E,11,E4,BD,5E,B9,88,08,3E7
23520 : 8E,12,04,BD,5B,B9,88,04,304
23528 : 8E,12,24,BD,5E,B9,88,02,322
23536 : 8E,12,44,BD,5E,B9,4C,8E,38F
23544 : 12,64,BD,5B,B9,86,F0,8E,44B
23552 : 11,7F,A7,84,30,88,E0,8C,3DF
23560 : 08,BF,24,F6,CC,FF,FF,30,4DB
23568 : 89,00,9E,ED,84,ED,88,E0,4ED
23576 : CD,00,C0,CD,00,A0,CD,00,5DF
23584 : 80,10,8E,60,11,EC,A1,ED,409
23592 : 84,30,88,20,10,83,00,00,1EF
23600 : 26,F3,86,C0,30,88,E0,C6,4BD
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23608 : 2D,A7,01,30,88,20,58,26,22D
23616 : F8,39,34,36,10,EE,60,28,2C4
23624 : EC,A1,ED,54,30,E8,20,10,3E6
23632 : 03,00,00,26,F3,35,B6,39,2C0
23640 : 39,BE,5F,6F,10,BE,54,09,2C0
23648 : BD,5D,07,39,BE,5F,01,10,2D0
23656 : BE,54,07,DD,5D,07,39,B6,32D
23664 : 54,05,10,27,00,FD,BE,5F,228
23672 : 93,10,BE,54,0B,BD,5D,07,2E1
23680 : 39,B6,54,33,10,27,00,99,216
23688 : BE,5F,93,10,BE,54,0D,DD,36C
23696 : 5D,07,39,B6,54,C2,10,27,1E0
23704 : 00,87,B6,54,24,10,27,00,1EC
23712 : 97,7F,54,24,BE,5F,99,10,324
23720 : BE,54,11,BD,5D,07,39,B6,333
23728 : 54,17,27,6D,B6,54,24,10,23D
23736 : 27,00,93,7F,54,24,BE,5F,29E
23744 : 99,10,BE,54,1A,BD,5D,07,2F6
23752 : 39,B6,54,04,27,53,B6,51,2CD
23760 : 24,10,27,30,6E,7F,54,24,1C0
23768 : BE,5F,99,10,BE,54,0F,BD,374
23776 : 5D,07,39,BE,5F,60,10,BE,2FB
23784 : 54,13,DD,5D,07,39,CE,6F,2AC
23792 : 6F,10,BE,54,09,31,A9,02,276
23800 : 00,A6,80,10,27,00,22,A7,226
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23816 : 00,01,00,10,27,00,11,A7,1F0
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23832 : 22,03,7E,5D,07,7E,EB,26,266
23840 : 39,39,BE,5F,E6,10,BE,54,367
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23856 : 10,BE,54,09,BD,5D,07,39,285
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23912 : A6,80,81,20,10,27,01,6F,2AE
23920 : 81,2E,27,08,81,5E,10,27,1F4
23928 : 01,6A,80,40,A7,A0,CC,07,345
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23944 : 26,F7,10,BC,06,20,26,D3,2DC
23952 : BE,5E,E9,10,BE,05,63,A6,3B1
23960 : 80,A7,A0,10,8C,05,79,26,307
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23976 : BE,00,CE,BF,54,26,ED,41,3D3
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23992 : 80,BC,06,00,26,F9,39,20,20A
24000 : 41,20,54,20,54,20,41,20,1AA
24008 : 43,20,48,20,20,4E,4E,20,1A8
24016 : 2E,2E,2E,2E,2E,2E,2E,20,1A2
24024 : 20,20,20,20,20,20,20,20,100
24032 : 20,20,20,20,20,20,43,41,144
24040 : 53,54,4C,45,20,47,48,41,228
24048 : 53,54,47,48,4F,52,41,48,260
24056 : 20,20,20,20,20,20,20,20,100
24064 : 57,52,49,54,54,45,4E,20,24D
24072 : 42,59,20,44,52,45,57,20,20B
24080 : 48,41,52,53,48,41,4C,4C,254
24088 : 2E,20,53,4D,4F,47,20,20,1C4
24096 : 43,4F,50,59,52,49,47,48,265
24104 : 54,2F,4B,45,59,53,20,54,232
24112 : 4F,20,55,53,45,20,41,52,20F
24120 : 45,2E,2E,2E,20,20,20,20,14F
24128 : 5E,5E,5E,5E,5E,5E,5E,5E,2F0
24136 : 5E,5E,5E,5E,5E,5E,5E,5E,2F0
24144 : 5E,5E,5E,5E,5E,5E,5E,5E,2F0
24152 : 5E,5E,5E,5E,5E,5E,20,20,274
24160 : 20,43,4C,45,41,52,2E,2E,1E3
24168 : 2E,2E,2E,4A,55,4D,50,20,1E6
24176 : 20,20,20,20,20,20,20,20,100
24184 : 20,20,20,20,20,20,20,20,100
24192 : 20,58,20,20,20,20,2E,2E,154
24200 : 7F,7F,7F,57,49,47,48,54,308
24208 : 20,20,20,20,20,20,20,20,100
24216 : 20,20,20,20,20,20,20,20,100
24224 : 20,5A,20,20,20,20,2E,2E,156
24232 : 7F,7F,7F,4C,45,46,54,20,185
24240 : 20,20,20,20,20,20,20,20,100
24248 : 20,20,20,20,20,20,20,20,100
24256 : 20,45,4E,54,45,52,2E,2E,1FA
24264 : 7F,7F,7F,47,4F,55,4E,43,201
24272 : 45,20,20,20,20,20,20,20,125
24280 : 20,20,20,20,20,20,20,86,166
24288 : 80,7E,5D,7C,B6,CC,7E,5D,404
24296 : 7E,5D,57,45,53,53,20,41,2A4
24304 : 4E,59,20,48,45,59,20,54,224
24312 : 4F,20,53,54,41,52,54,20,21D
24320 : 47,41,4D,45,86,E5,37,FF,43B
24328 : 22,B7,FF,C3,B7,FF,25,B7,3CD
24336 : FF,C7,86,00,BE,06,00,A7,3B7
24344 : 80,BC,1E,00,26,F9,3E,0F,2E6
24352 : 82,BF,54,09,7F,54,15,7F,305
24360 : 54,20,86,00,B7,54,00,7F,284
24368 : 54,21,7F,54,01,7F,54,13,22F
24376 : 7F,54,23,B6,01,B7,54,24,2AC
24384 : B7,54,25,7F,54,28,7F,54,2FE
24392 : 29,7F,54,2A,7F,54,2B,7E,2A3
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24408 : CC,0A,05,FD,54,31,86,01,2E4
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24456 : 9E,94,[illegible],AB,30,30,CC,CC,470
24464 : F3,00,00,02,08,FC,08,02,203
24472 : 0C,3C,E7,DB,E7,DB,3C,00,3FC
24480 : 3C,7E,FF,3C,24,3C,7E,56,329
24488 : 6F,56,7E,66,66,66,66,E7,3AD
24496 : E7,C0,03,C0,0F,F0,0F,F0,3AB
24504 : 05,50,45,50,41,40,7F,FD,2E7
24512 : 7D,7D,75,5D,75,5D,7D,7D,398
24520 : 3D,7D,0D,71,03,C1,2D,2D,24C
24528 : 28,28,28,28,28,28,28,28,140
24536 : 6B,29,54,15,00,00,02,07,103
24544 : 07,C2,02,02,02,00,FC,1F,12A
24552 : 5F,17,08,04,26,26,26,2A,124
24560 : 0C,CC,0C,0C,3C,3C,00,00,AB
24568 : FC,1F,5F,17,08,0A,26,26,1EF
24576 : 16,1A,2A,0C,0C,33,33,CF,1A7
24584 : 00,C0,3C,DB,E7,DB,E7,3C,3FC
24592 : 00,C1,40,05,50,05,50,05,F0
24600 : 50,C5,50,15,54,15,54,15,18C
24608 : 54,15,54,15,54,15,54,55,1E4
24616 : 55,C0,00,55,55,FD,FD,FD,3F6
24624 : FD,FD,FD,55,55,DF,DF,DF,63E
24632 : DF,DF,DF,55,55,00,00,FF,446
24640 : C3,C3,C3,C3,C3,C3,FF,F0,6B1
24648 : 30,30,30,30,30,30,FC,3C,258
24656 : C3,03,0C,30,CC,C0,FF,3C,3BD
24664 : C3,03,0C,0C,03,C3,3C,CC,2AC
24672 : CC,CC,F3,0C,0C,0C,0C,3F,303
24680 : C0,CF,F3,03,03,C3,3C,3F,3C3
24688 : C0,C0,FF,C3,C3,C3,3C,FF,603
24696 : 03,0C,30,C0,CC,C0,C0,3C,37B
24704 : C3,C3,3C,C3,C3,C3,3C,3C,483
24712 : C3,C3,C3,3F,03,03,03,A5,334
24720 : 99,99,A5,99,99,99,A5,00,447
24728 : 65,99,99,99,95,99,99,65,460
24736 : C0,65,99,99,99,99,99,99,3FB
24744 : 99,00,99,99,96,99,99,99,42F
24752 : 99,65,00,69,95,95,69,59,353
24760 : 59,59,A5,00,00,20,3F,20,256
24768 : E0,00,00,01,00,00,00,00,81
24776 : C0,00,00,00,01,00,00,00,1
24784 : C0,00,01,01,01,00,00,00,3
24792 : C1,00,00,00,00,01,01,01,4
24800 : C0,00,01,00,01,01,00,02,5
24808 : C0,00,01,00,00,02,00,00,3
24816 : C1,01,00,00,01,01,01,00,5
24824 : C1,01,00,00,01,00,01,02,6
24832 : 00,00,01,0C,01,02,01,00,5
24840 : C0,00,00,02,00,01,01,01,5
24848 : 01,01,00,0C,01,01,01,00,05
24856 : 10,27,F5,EF,8C,06,00,10,28D
24864 : 23,F5,E8,5F,E7,84,30,88,482
24872 : 20,49,26,FF,39,4F,8F,0A,2A4
24880 : 00,A7,80,BC,1E,00,26,F9,2F0
24888 : 39,34,32,B6,FF,23,8A,08,309
24896 : B7,FF,23,BE,00,01,B6,FD,3EB
24904 : B7,FF,20,BE,16,7F,FF,20,417
24912 : BD,11,30,01,BC,54,26,25,22A
24920 : EB,B6,FF,23,84,F7,B7,FF,5F6
24928 : 23,35,B2,1F,12,31,3F,26,1D1
24936 : FC,39,FF,FF,FF,FF,FF,FF,72F
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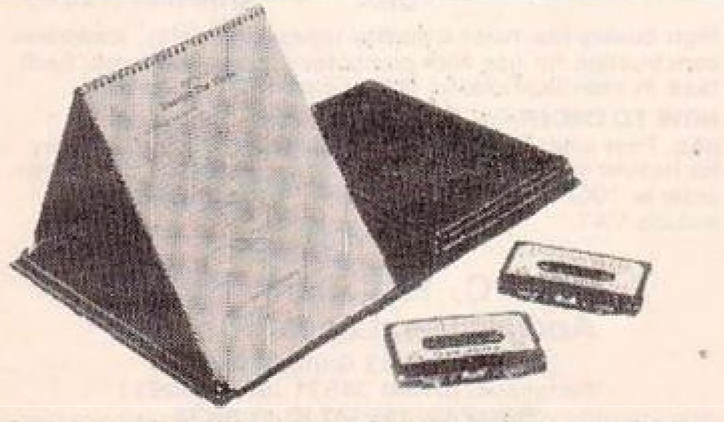
It was discovered that the micro is hopelessly under-utilised. If you're already a micro owner, your own experience may well confirm this unhappy state of affairs.

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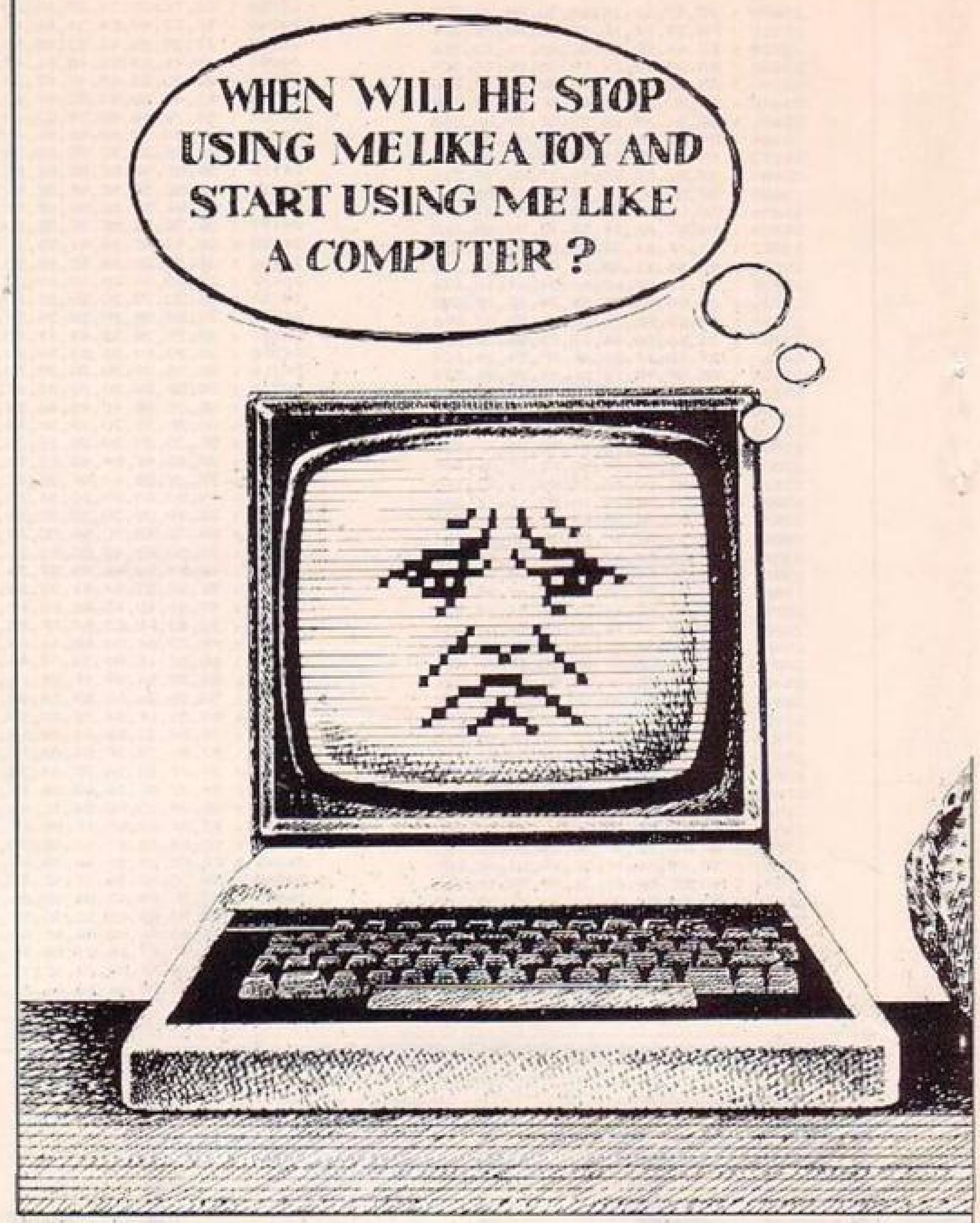
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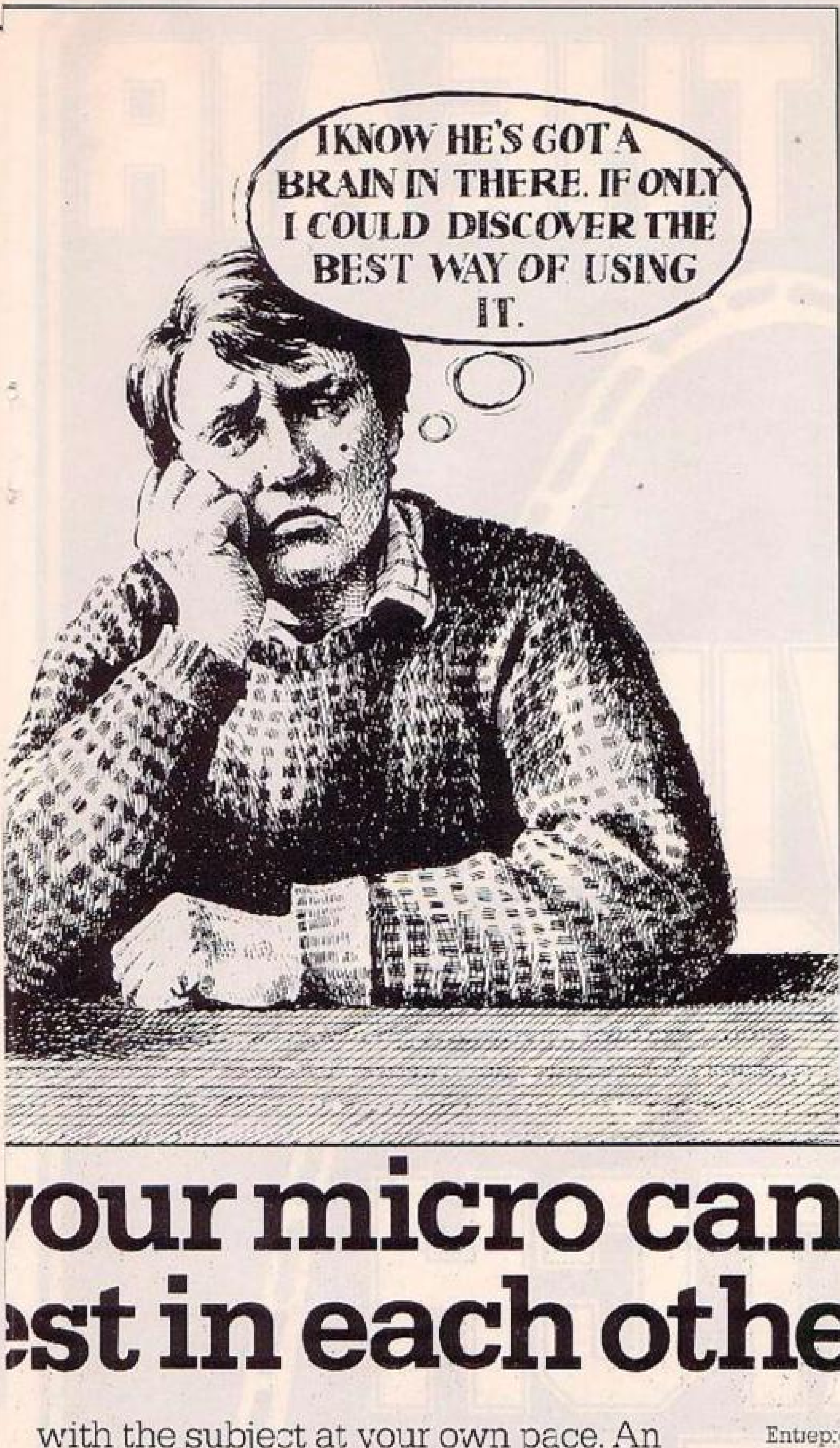
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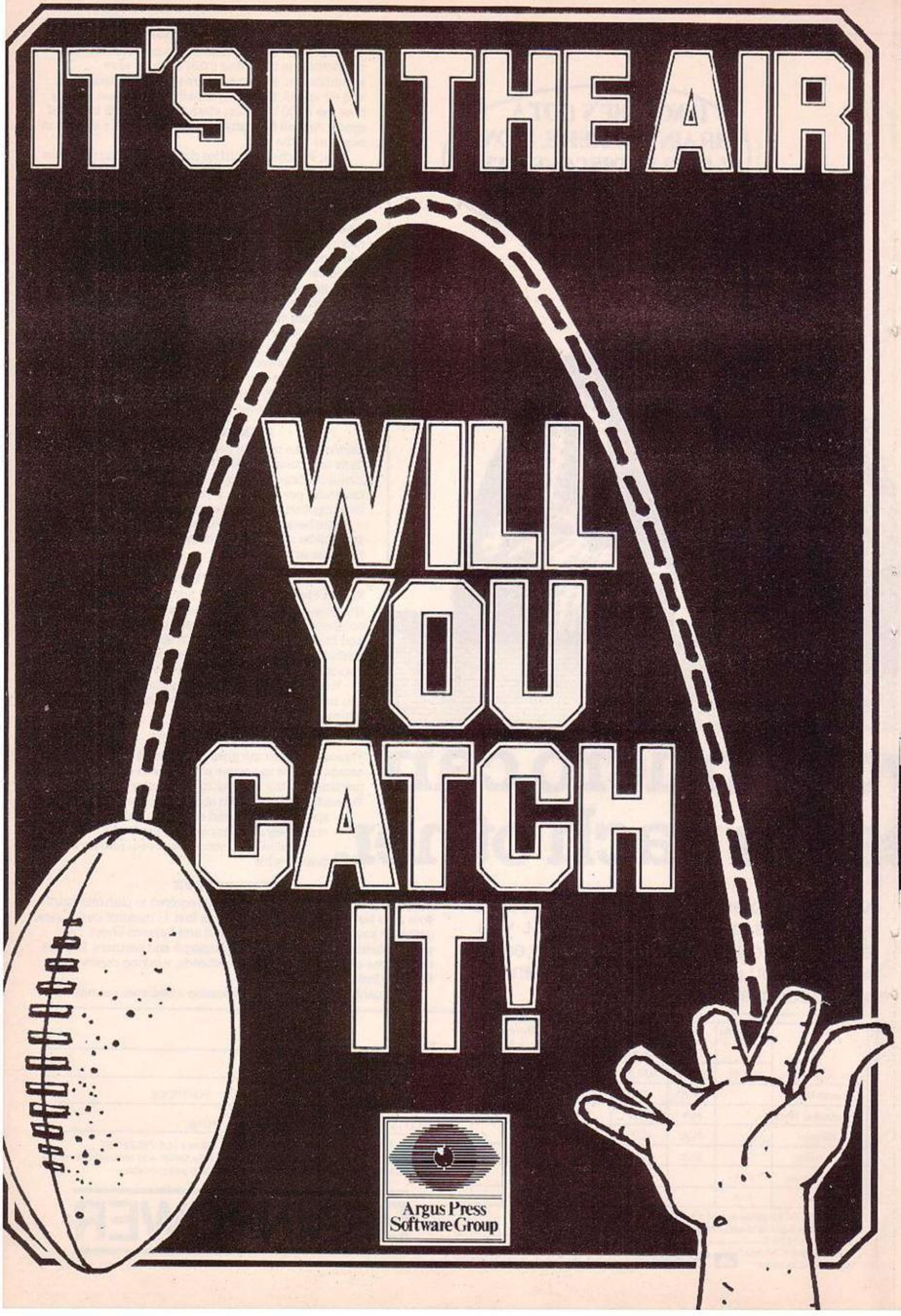
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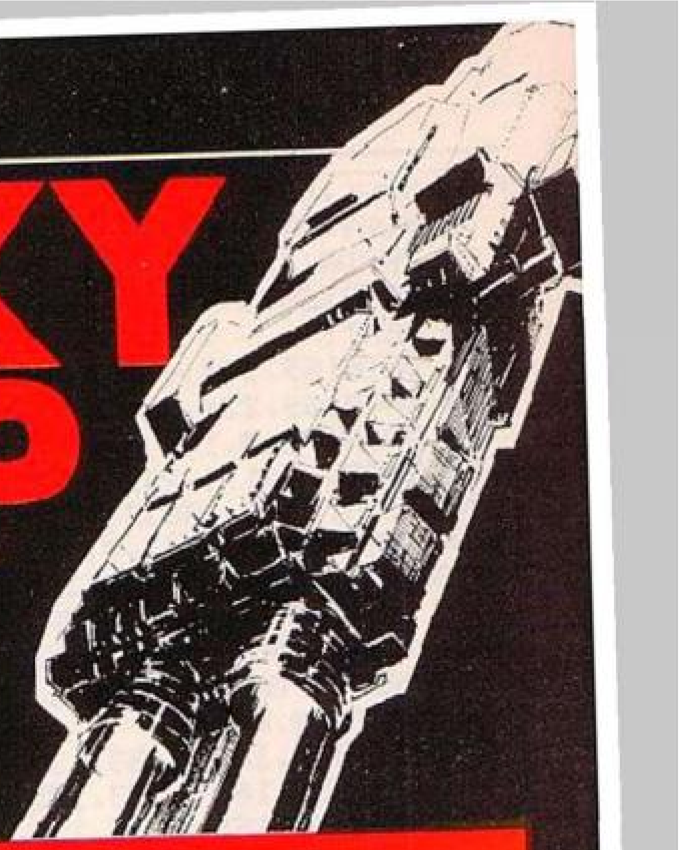

IT'S IN THE AIR
WILL
YOU
CATCH
IT!
Argus Press
Software Group

SKY DROP

Rod Markham puts the Amstrad through its paces.

I HAVE TRIED to incorporate as many of the advanced features of Locomotive Basic as possible into this game for the Amstrad CPC-464; for example, high-res moving graphics and three channel-sound. Three well-known tunes have been included in the game — *Star Wars, Funeral March, Congratulations.*

The game is set on a hostile planet where the atmosphere is hydrochloric acid vapour. When clouds form, the vapour condenses to make concentrated acid. The sea at the bottom of the screen is also acid. At the start, a small skycraft hovers along to the middle of the screen. A small device is dropped from it and the idea of the game is to guide this device on to a randomly moving acid-proof platform which is floating on the acid sea.

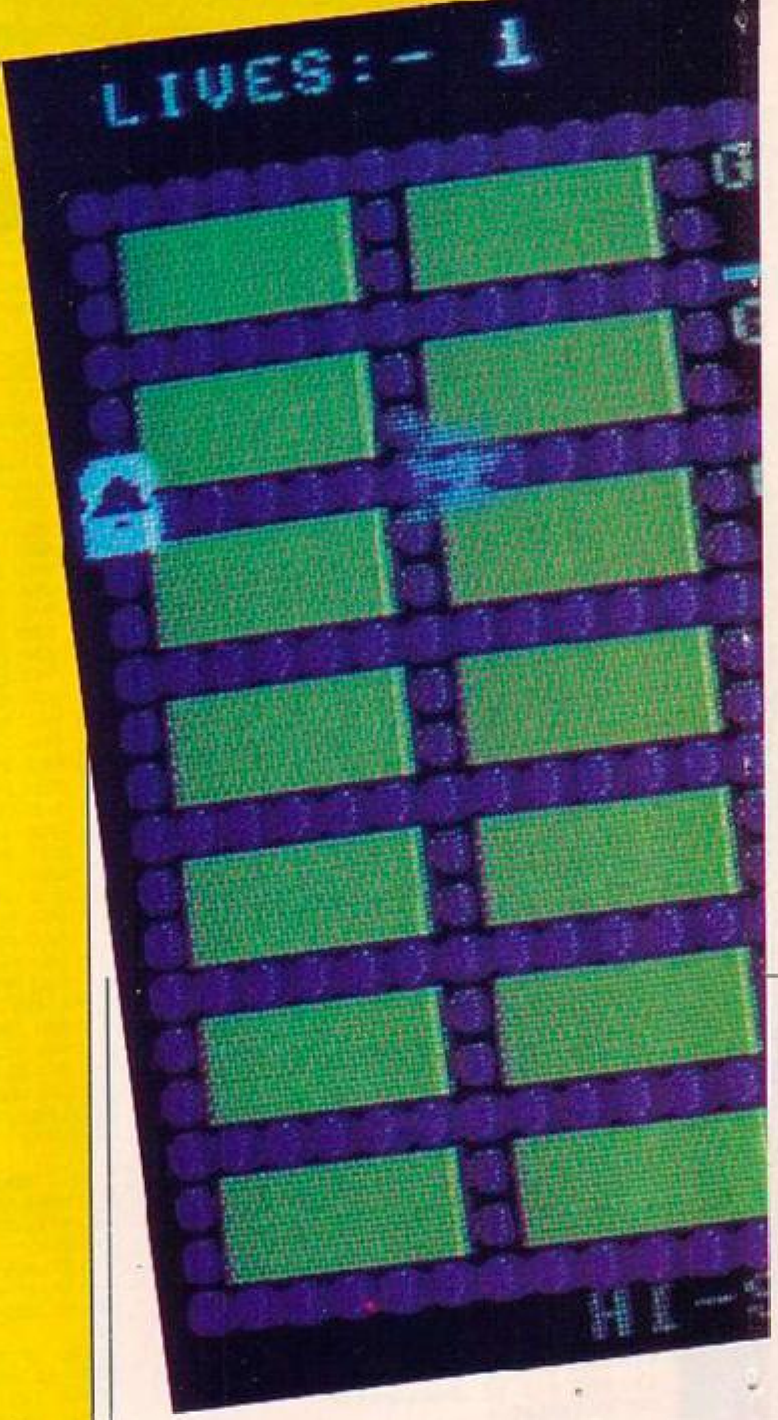


As both the sea and the clouds are acid, they must both be avoided. There is also a laser field which fires eight blasts then rests for two. To get past this, the craft must hover just above the laser beam until it stops firing. To do this the thrust key is used. Thrusting uses up fuel so be careful as there are only 30 units.

```
20 REM*************SKY DROP*****************
30 REM*********BY R.MARKHAM**************
40 REM*******AND S.JOHNSON.*************
80 GOSUB 1560
90 INK 3,20
100 INK 2,6
110 INK 1,0
120 HI=0
130 CL.H=150
140 LIVES=3
150 SCORE=0
160 ENV 4,15,-1,1
170 ENT 1,30,10,1
180 ENV 5,15,-1,10
190 FUEL=30
200 SYMBOL AFTER 205
210 SYMBOL 221,8,15,3,,3,,15,63,111,127
220 SYMBOL 222,0,0,224,224,128,255,201,2
55
230 SYMBOL 223,0,0,0,0,0,192,32,240
240 SYMBOL 212,111,63,4,31,0,0,0,0
250 SYMBOL 213,255,255,4,255,0,0,0,0
260 SYMBOL 214,255,128,0,0,0,0,0,0
270 SYMBOL 215,0,0,0,0,0,3,2,6
280 SYMBOL 216,0,0,0,0,&X110110,&X10010
01,&X1001001,2
290 SYMBOL 217,0,0,0,0,0,128,64,64
300 SYMBOL 218,&X101,&X111100,&X10000C,&
X1000000,&X1001000,&X111111,3,0
310 SYMBOL 219,0,0,0,0,144,255,255,0
320 SYMBOL 220,&X1110000,&X1C001000,&X11
00,&X110010,&X100C10C,&X11111000,&X110000
00,0
330 BORDER 1:INK 0,0
340 CLS
350 MODE 0
360 X=5
370 RESTORF 1400
380 READ NOTE,DUR
390 SOUND 1,NOTE,DUR,15
400 PEN 1
410  PRINT"*****SKY DROP******"
420 X=X+1:IF X>13 THEN  440
430 GOTO 380
440 READ NOTE,DUR:IF NOTE=9999 THEN GOTO
 500
450 SOUND 1,NOTE,DUR,15
460 PEN X
470 PRINT"*****SKY DROP******"
480 X=X-1
490 GOTO 440
500 PEN 7:PRINT "*****SKY DROP******"
510 PEN 6:PRINT "*****SKY DROP******"
520 PEN 5:PRINT "*****SKY DROP******"
530 FOR K=1 TO 2000:NEXT
540 CLS:MODE 1
550 WINDOW 4,36,2,5
560 BORDER 18:INK 0,11
570 ENV 1,10,-1,2
580 ENV 2,15,1,3
590 ENV 3,1,0.2,15,-1,20
600 S=6
610 CLG
620 DROP=200
630 BASE=220
640 DRIFT=290
650 PLOT 38,392,1:DRAWR  544,0:DRAWR 0,-
73:DRAWR -544,0:DRAWR 0,73
660 TAG
670 PLOT 0,0,1
680 FOR X=1 TO DRIFT-4 STEP 2
690 MOVE X,DROP+32
700 PRINT CHR$(221);CHR$(222);CHR$(223);
710 MOVE X,DROP+16:PRINT CHR$(212);CHR$(
213);CHR$(214);
720 PITCH=INT(RND(1)*60)+12
730 SOUND 2,PITCH,2,15,0,0,1
740 NEXT X
750 MOVE 1,175:PRINT CHR$(246);
760 MOVE 624,175:PRINT CHR$(247)
770 TAGOFF
780 CLOUD=250
790 CLOUD2=base
800 REM*******START LOOP**************
810 TAG
820 PLOT 0,0,1
830 MOVE X,DROP+32:PRINT CHR$(221);CHR$(
222);CHR$(223);
840 MOVE X,DROP+16:PRINT CHR$(212);CHR$(
213);CHR$(214);
850 TAGOFF
860  FUEL=30
870 IF A<=0 THEN ST=-1 ELSE ST=1
880 A=INT(RND(1)*-20)+10
890 FOR P=1 TO A STEP ST
900 PEN 3:LOCATE 1,2:PRINT"FUEL==";FUEL
910 LOCATE 1,3:PRINT"DRIFT=";DRIFT
920 LOCATE 1,1:PRINT"LIVES=";LIVES
930 LOCATE 1,4:PRINT"DROP==";DROP
940 LOCATE 12,4:PRINT"SCORE=";SCORE
950 SCORE=SCORE+1
960 BUTT$=INKEY$
970 IF BUTT$=L$ THEN DRIFT=DRIFT-S
980 IF BUTT$=R$ THEN DRIFT=DRIFT+S
990 IF BUTT$=T$ AND FUEL>1 THEN DROP=DRO
P+S:FUEL=FUEL-1: IF FUEL<1 THEN FUEL=0
1000 DROP=DROP-S:IF DROP<=8 THEN 1210
1010 BASE=BASE+P*(S/3):IF BASE<=0 THEN B
ASE=1
1020 IF BASE>=575 THEN BASE=575
1030 CL.H=CL.H-1
1040 TAG
1050 PLOT 0,0,1
1060 MOVE BASE,12:PRINT " ";CHR$(209);CH
R$(189);CHR$(211);" ";
1070 CALL &BD19
1080 CLOUD=CLOUD+(INT(RND*6))-3
1090 CLOUD2=BASE
1100 MOVE CLOUD,220:PRINT " "; CHR$(215)
;CHR$(216);CHR$(217);" ";:MOVE CLOUD,204
:PRINT " ";CHR$(218);CHR$(219);CHR$(220)
;" ";
1110 MOVE CLOUD2,CL.H:PRINT " ";CHR$(215
);CHR$(216);CHR$(217);" ";:MOVE CLOUD2,C
L.H-16:PRINT " "CHR$(218);CHR$(219);CHR$
(220);" ";
1120 MOVE DRIFT,DROP:PRINT CHR$(46);
1130 IF DRIFT>=CLOUD+16 AND  DRIFT<=CLOU
D+48 AND DROP<=220 AND DROP>=204 THEN 12
30
1140 IF DRIFT>=CLOUD2+16 AND  DRIFT<=CLO
UD2+48 AND DROP<=CL.H AND DROP>=CL.H-16
THEN 1230
1150 TAGOFF
1160 IF LASER <=7 THEN INK 2,6:PLOT 16,1
68:INK 2,6:DRAW 620,168,2:SOUND 1,10,30,
 5,6,1:IF 168<=DROP AND 168>=DROP-16 THE
N SOUND 7,0,150,15,5,0,15:GOTO 1230
1170 LASER=LASER+1:IF LASER=11 THEN LASE
R=0
1180 INK 2,11
1190 NEXT  P
1200 GOTO 370
1210 REM*******TEST LAND**************
1220 IF DRIFT>=BASE-16 AND DRIFT <=BASE+
50 THEN GOTO 1320
1230 TAGOFF:LOCATE 12,1:PEN 15:PRINT "YO
U FAILED!TRY AGAIN";
1240 FOR V=1 TO 150:C=INT(RND*15)+1:SOUN
D 1,C,3,15,0,0,C:NEXT V
1250 LIVES=LIVES-1
1260 CL.H=150-SC
1270 RESTORE 1410
1280 READ NOTE,DUR:IF NOTE=9999 AND LIVE
S<1 THEN 1430
1290 IF NOTE=9999 THEN 540
1300 SOUND 1,NOTE,DUR,0,2
1310 GOTO 1280
1320 RESTORE 1420
1330 LOCATE 12,1:PEN 15:PRINT "YOU SUCCE
EDED!"
1340 LOCATE 12,3:PEN 15:PRINT "TRY A HAR
DER LEVEL"
1350 SCORE=SCORE+(FUEL*10)+100
1360 SC=SC+10:CL.H=150-SC
1370 READ NOTE:IF NOTE=9999 THEN 540
1380 SOUND 4,NOTE,20,15,1
1390 GOTO 1370
1400 DATA 478,50,319,50,358,13,379,13,42
6,13,239,60,319,60,358,13,379,13,426,13,
239,60,319,60,358,15,379,15,358,15,426,7
0,9999,9999
1410 DATA 1911,120,1911,80,1911,40,1911,
120,1607,80,1703,40,1703,80,1911,40,19.1
,80,1025,40,1911,120,9999,9999
1420 DATA 60,53,47,45,60,0,45,47,45,40,5
3,0,53,47,45,36,40,40,45,45,47,53,47,60,
9999
1430 REM ********END***********
1440 MODE 0:CLS
1450 SPEED INK 30,30
1460 BORDER 7,12
1470 INK 0,7
1480 IF SCORE>HI THEN HI=SCORE
1490 LOCATE 5,1:PEN 14:PRINT"SCORE: ";SCO
RE
1500 LOCATE 5,5:PEN 15:PRINT"HI-SCORE: ";
HI
1510 LOCATE 2,10:PEN 6
1520 PRINT"DO YOU WANT ANOTHER GO?"
1530 LOCATE 7,15:INPUT"Y/N";Z$
1540 IF Z$="Y"THEN GOTO 130
1550 END
1560 MODE 1:INK 0,0:INK 2,10:INK 1,10:BO
RDER 1
1570 PRINT"********SKY DROP INSTRUCTIONS
*******"
1580 PRINT
1590 PRINT"    You must guide a small dev
ice,which  is dropped from a hovering sp
ace craft, onto a moving platform.This p
latform    is floating on an ACID sea,so
 if the    device misses,it will be diss
olved."
1600 PRINT"    To make the task more dema
nding,thereare several hazards which mus
t be        aviodea.
             ACID clouds,which drift ab
out above  the sea,are also able to diss
olve the   device."
1610 PRINT"    Also,there is an automatic
 laser      field,which gives regular bur
sts of fireYou must wait above this unti
l it stops to re-energize,using THRUST.W
hen it      stops,you must quickly drop t
hrough it,"
1620 PRINT"before it starts up again.
             You will have THREE chance
s to land  the device before the game en
ds.          Remember that you can only
 use        THIRTY fuel units.When there
are none   left,you will drop."
1630 PRINT"      PRESS 'SPACE' TO CONTINUE
"
1640 IF INKEY$=" "THEN GOTO 1660
1650 GOTO 1640
1660 CLS
1670 PRINT"*******************CONTROLS****
***********"
1680 PRINT
1690 PRINT
1700 PRINT
1710 INPUT"             KEY FOR LEFT=====";L$
1720 INPUT"             KEY FOR RIGHT====";R$
1730 INPUT"             KEY FOR THRUST===";T$
1740 RETURN
```

Program 1. Music.

```
10 FORT=0TO2:FORX=0TO255
20 READA:IFA=-1THEN40
30 POKE36864+T*256+X,A:NEXTX
40 NEXTT
50 DATA169,146,141,21,3,169,0,141,20,3,96,-1
60 DATA169,234,141,21,3,169,49,141,20,3,96,-1
70 DATA172,0,147,192,17,240,57,206,1,147,173,1,147,201,0,208,44,238,0,147,169
80 DATA0,141,4,212,169,10,141,5,212,169,0,141,6,212,169,17,141,4,212,185,0,147
90 DATA185,0,148,141,1,212,185,0,149,141,0,212,185,0,150,141,1,147,76,49,234
100 DATA169,0,141,0,147,141,4,212,24,144,242,-1
110 POKE37632,0:POKE37633,0
120 FORT=0TO202:READHF,LF,D
130 POKE37888+T,HF:POKE38144+T,LF:POKE38400+T,D
140 NEXT:POKE37380,T-1
142 DATA28,49,8
143 DATA31,165,8,33,135,8,42,62,8,28,49,8
144 DATA31,165,8,33,135,8,42,62,8,28,49,8
145 DATA31,165,8,33,135,8,42,62,8,28,49,8
146 DATA31,165,8,33,135,8,42,62,8,28,49,8
147 DATA31,165,8,33,135,8,42,62,8,28,49,8
148 DATA31,165,8,33,135,8,42,62,8,28,49,8
149 DATA31,165,8,33,135,8,42,62,8,28,49,14
150 DATA21,31,14,21,31,14,22,96,14,22,96,14
160 DATA21,31,14,21,31,14,22,96,14,22,96,14
170 DATA21,31,14,21,31,14,22,96,14,22,96,14
180 DATA21,31,14,21,31,14,28,49,14,28,49,14
190 DATA26,156,30,37,162,14,37,162,30,37,162,14
200 DATA33,135,60,21,31,14,21,31,14,22,96,14
210 DATA22,96,14,21,31,14,21,31,14,22,96,14
220 DATA22,96,14,21,31,14,21,31,14,22,96,14
230 DATA22,96,14,21,31,14,21,31,14,28,49,14
240 DATA28,49,14,26,156,30,44,193,14,44,193,30
250 DATA44,193,14,42,62,60,21,31,14,37,162,14
260 DATA37,162,30,33,135,7,33,135,45,33,135,15
270 DATA31,165,14,31,165,30,33,135,7,31,165,7
280 DATA28,49,50,37,162,14,37,162,30,33,135,14
290 DATA33,135,30,33,135,14,31,165,14,31,165,30
300 DATA33,135,7,31,165,7,28,49,45,28,49,14
310 DATA28,49,14,31,165,14,31,165,14,28,49,14
320 DATA28,49,14,31,165,14,31,165,14,28,49,14
330 DATA28,49,14,31,165,14,31,165,14,28,49,14
340 DATA28,49,14,33,135,14,33,135,14,31,165,30
350 DATA21,31,14,22,96,14,18,209,14,21,31,14
360 DATA15,195,14,18,209,14,15,210,14,21,31,14
370 DATA22,96,14,18,209,14,21,31,14,16,195,14
380 DATA18,209,14,15,210,14,16,195,45,28,49,14
390 DATA31,165,14,33,135,14,28,49,14,31,165,14
400 DATA33,135,30,33,135,14,28,49,14,31,165,14
410 DATA33,135,30,31,165,14,28,49,14,33,135,14
420 DATA33,135,30,28,49,3,28,49,70
430 DATA28,49,14,31,165,14,33,135,14,28,49,14
440 DATA31,165,14,33,135,45,33,135,14,28,49,14
450 DATA31,165,14,33,135,45,31,165,14,28,49,14
460 DATA33,135,12,33,135,28,28,49,60,28,49,14
470 DATA44,193,45,50,60,7,44,193,7,37,162,14
480 DATA42,62,60,44,193,14,42,62,14,44,193,14
490 DATA42,62,14,28,49,14,37,162,45,33,135,28
500 DATA31,165,28,28,49,14,31,165,14,33,135,14
510 DATA28,49,14,31,165,14,33,135,45,31,165,14
520 DATA28,49,14,33,135,10,33,135,28,28,49,60
530 DATA42,62,12,42,62,12,42,62,12,42,62,12
540 DATA21,31,7,28,49,7,33,135,7,42,62,7
550 DATA39,223,12,39,223,12,39,223,12,39,223,12
560 DATA39,223,12,39,223,12,22,96,7,28,49,7
570 DATA33,135,7,42,62,35,31,165,14,28,49,14
580 DATA33,135,10,33,135,35,28,49,45
1000 POKE54296,15:SYS36864
```



BULLION FOR THE C3M-64 is split into two parts: part one is loaded first and run. This part, called Music, uses the system interrupt to play the background music for the game. It is initiated by the command

SYS36864

and is stopped by the command

SYS36864+256

For this particular game I have stored the music data in locations 9000 (hex) onwards. There is, however, no reason why anybody with machine-code knowledge could not use this program to make music for their own games, and re-locate the data to wherever they wish.

In the listing for music, lines 10 to 40 are the loader, line 50 is the machine-code data to

BULLION

Robert Dunk has hoarded this program long enough. Now you can all go for gold on the CBM-64.



Program 2. The main program.

```
0 GOSUB2000
1 FORT=1TO10:SC(T)=0:SH$(T)="■■■ GOLD BARS ■■■":NEXT
5 WA=54290:AD=54291:SR=54292:HI=54287:LO=54286:OT=49152
9 PRINT"□":POKE53280,11:POKE53281,11:LV=3
10 IFPEEK(OT)<>165THENFORT=7:1TO716:READA:POKET,A:NEXT
20 DATA2,8,14,20,26,32
30 POKE251,1:SR=1:POKE828,0:DA=0:MO=0
40 V=53248:POKEV+21,3:POKE2040,13:POKE2041,14
50 POKE2042,14:POKEV+4,38:POKEV+5,220
60 POKEV,38:POKEV+1,62:POKEV+2,220:POKEV+3,220:POKEV+40,15:POKEV+39,1
65 IFPEEK(OT)=165THEN90
70 FORT=0TO7:READA:POKE679+T,A:NEXT:FORT=0TO6:READA:POKE780+T,A:NEXT
80 DATA62,84,108,132,156,180,204,228,30,75,124,172,220,12,76
90 FORT=760TO766:POKET,0:NEXT:POKE767,1:POKE53247,0:POKE53246,3:T=0
95 IFPEEK(OT)=165THEN150
97 FORT=0TO64:POKE832+T,0:POKE896+T,0:NEXT:T=0
100 READA:IFA=-1THEN141
110 POKE896+T,A:T=T+1:GOTO100
120 DATA0,192,24,1,192,28,1,224,60,0,111,176,3,63,224,0,127,240,0,197,24
130 DATA0,197,24,0,255,248,0,120,240,0,63,224,0,57,96,0,24,192,0,63,224,0,111
140 DATA176,1,159,28,1,192,28,-1
141 T=0:POKE828,0
142 READA:IFA=-1THEN150
143 POKE832+T,A:T=T+1:GOTO142
144 DATA0,127,224,0,255,240,1,255,248,1,249,248,1,240,248,1,224,120,0,224,112
145 DATA0,192,48,1,128,24,1,255,248,1,249,248,1,255,248,1,255,248,1,255,248
146 DATA1,255,248,-1
150 IFPEEK(49152)<>165THENGOSUB500
152 GOSUB1000
155 A=PEEK(53278):POKE37632,0:POKE37633,0:SYS36864:POKE54296,15
160 FORT=1TO3000:NEXT:PRINT"■■■■LIVES :-■"LV TAB(20)"■SCREEN■"SR
163 PRINT"■■■■■■■■■■■■■■■■■■■■■■■■"TAB(10)"■HI-SCORE -■"SC(1);
170 POKE198,0:SYS49152
175 IF(PEEK(53278)AND1)THEN185
176 IFPEEK(163)=1THEN350
185 REM ■■■■■■■■■■■ KILLED ■■■■■■■■■■■
187 POKE54296,0:SYS36864+256
188 GOSUB1500
190 X=PEEK(V+21):POKEV+21,0
195 POKEV+16,0:POKEV,38:POKEV+1,62:POKEV+2,220:POKEV+3,220
200 POKEV+4,38:POKEV+5,220:LV=LV-1:IFLV=0THEN1500
210 POKEV+21,X:FORT=760TO766:POKET,0:NEXT:GOTO155
345 REM ■■■■■■ SCREEN FILLED ■■■■■■■■■
350 POKE54296,0:SYS36864+256:FORT=1TO1500:NEXT:POKEV+21,0
352 PRINT"■■■■■■■■■■■■■■■■■■■■■SCREEN"SR"COLLECTED":FORT=1TO2000:NEXT
355 PRINT"■■■■■■■■■■■■■■■■■■STAND BY !":FORT=1TO2000:NEXT
360 POKEV+16,0:POKEV,38:POKEV+1,62:POKEV+2,220:POKEV+3,220
370 POKEV+4,38:POKEV+5,220:SR=SR+1:IFSR=2THENMO=MO+2:POKE828,1
380 IFSR=3THENMO=MO+4:POKE828,1
382 IFSR=4THENPOKE828,2
384 IFSR=6THENLV=LV+1
399 POKEV+21,1+MO:FORT=760TO766:POKET,0:NEXT
400 GOTO152
500 PRINT"■■■■■■■■■■■■■■■■■■■■■■PLEASE WAIT WHILE I"
502 PRINT"■■■■■■■■LOAD IN THE MACHINE CODE."
504 PRINT"■■■■■■■■■■!!!! THANK YOU ! !!"
505 FORT=0TO3:X=0
510 READA:IFA=-1THEN530
520 POKE49152+T*256+X,A:X=X+1:GOTO510
530 NEXT:GOTO980
535 REM ■■■■■ INPUT MOVE DATA ■■■■■
540 DATA165,197,201,12,240,24,201,20,208,3,76,55,192,201,4,208,3,76,80,192,201
550 DATA5,208,3,76,105,192,76,0,193
555 REM ■■■■■ VALIDATE MOVE LEFT ■■■■■
560 DATA160,0,173,1,208,217,167,2,240,8,200,192,8,208,246,76,0,193,169,1,173
570 DATA251,76,0,193
575 REM ■■■■■ VALIDATE MOVE RIGHT ■■■■■
580 DATA160,0,173,1,208,217,167,2,240,8,200,192,8,208,246,76,0,193,169,2,133
590 DATA251,76,0,193
595 REM ■■■■■ VALIDATE MOVE UP ■■■■■
600 DATA160,0,173,0,208,217,180,2,240,8,200,192,6,208,246,76,0,193,169,3,133
610 DATA251,76,0,193
615 REM ■■■■■ VALIDATA MOVE DOWN ■■■■■
620 DATA160,0,173,0,208,217,180,2,240,8,200,192,6,208,246,76,0,193,169,4,133
630 DATA251,76,0,193,-1
635 REM ■■■■ CHECK SPRITE MOVEMENT ■■■■■
640 DATA165,251,201,1,240,40,201,2,240,71,201,3,240,16
645 REM ■■■■■■■■■ MOVE DOWN ■■■■■■■■■■■
650 DATA173,1,208,201,228,240,6,238,1,208,238,1,208,76,0,194
655 REM ■■■■■■■■■ MOVE UP ■■■■■■■■■■■■
660 DATA173,1,208,201,62,240,6,206,1,208,206,1,208,76,0,194
```

(continued on next page)

point the system interrupt to the music program itself. Line 60 is the data to point the interrupt back to its original place. Lines 70-100 are the data for the actual music program itself. In line 110 the

POKE 37632,0

is to set the count of the number of notes in the music to zero, the

POKE 37633,0

sets the length of the present note to zero.

Lines 120-140 read the music data and store it so that the machine-code routine can read it as needed. Then the loop in line 120 is from zero to the number of notes in the music to be played — minus 1.

Lines 142 to 580 are the music data itself. They are in the form of high frequency, low frequency and duration of the note itself. The most notes that can be played is 255, which should give any budding Mozart enough scope to write his own music.

Finally line 1000 turns the sound to full and calls the routine. The music can also be stopped by Run/Step and Restore.

The main beauty of this program, though, is that the music plays and repeats regardless of whatever else the computer is asked to do!

The main game Bullion is written nearly all in machine code. This is because sprites are used and using sprites in Basic is painfully slow. The only times the game exits machine-code is when either your man is caught or a screen is filled. Basic is then used to update the lives, screen, etc. All instructions for the program are included and I have left enough Rems in the listing for anybody who wishes to break down the machine code to do so.

The idea is that you have been given a treasure map; you must collect all the gold bars. To do this you must surround them with your footsteps; when this is done they will fill in to show that they have been collected. When they have all been collected the next screenful is displayed.

At the start of the game you are given three lives, and on the first screen only one pirate is chasing you. The pirates are the skull and crossbones, you are the treasure chest. On the second screen there is still only one pirate but he moves twice as fast. On the third screen there are two pirates, one travels at half speed and the other at full speed. On the fourth and successive screens there are still only two pirates but there speeds are swopped. An extra life is given if the fifth screen is cleared.

When all your lives have been lost the computer asks for your name. Your score — if it is big enough — is then entered in an all-time best score routine. This routine keeps track of the 10 best scores for game.

If typing this epic is too much, I can supply it on tape for £3 including post and packing. Please send your enquiries in writing to Robert Dunk, 171 Corneville Road, Bucknall, Stoke-on-Trent ST2 9ET.

Locations and their uses.

Location	Use
251	This holds the direction of your man, 1 = left 2 = right: 3 = up: 4 = down.
252-253	These hold the X and Y position used in the Kernal Print Routine to print the man's footsteps.
255	This holds monster number one's direction.
164	This holds monster number two's direction.
711-716	These locations are used to store the vertical positions of the grid for use in the check block routines.
679-686	These store the Y positions of the grid for use in comparisons for sprite movement.
700-706	These hold the X positions.
820	This location is used to call the "Pirates" again.

(continued from previous page)

```
669 REM ******** MOVE LEFT ***********
670 DATA173,0,208,201,30,208,7,173,16,208,41,1,240,15,56,206,0,208
675 DATA206,0,208,208,9,173,16
680 DATA208,73,1,141,16,208,24,76,0,194
689 REM ******** MOVE RIGHT ***********
690 DATA173,0,208,201,12,208,7,173,16,208,41,1,208,15,24,238,0,208
695 DATA238,0,208,208,9
700 DATA173,16,208,73,1,141,16,208,24,76,0,194,-1
709 REM **** FIND X CO-ORDINATE *****
710 DATA173,0,208,160,0,56,233,8,144,3,200,208,248,106,192,2,48,1,24,144,5
720 DATA152,24,105,32,168,132,252
729 REM **** FIND Y CO-ORDINATE *****
730 DATA173,1,208,162,0,56,233,8,144,3,232,208,248,202,202,202,202,202,134,253
739 REM *** PLOT CURSOR POSITION ****
740 DATA24,164,252,166,253,32,240,255,165,206,119,207
749 REM ** PRINT COLOUR UNDER CURSOR *
750 DATA169,156,32,210,255,169,113,32,210,255,76,0,195,-1
759 REM ****** LOAD ONE'S ******
760 DATA160,0,169,1,153,206,2,200,192,41,240,3,24,144,243
761 REM ** CHECK BLOCKS 1-5 TOP LINE **
762 DATA160,2,162,1,185,80,4,201,81,208,16,152,221,199,2,240,3,200,208,240
763 DATA224,5,240,11,232,208,233,169,0,157,205,2,24,144,232
764 REM ***** CHECK BOTTOM LINE ******
765 DATA160,2,162,1,185,200,4,201,81,208,16,152,221,199,2,240,3,200,208,240
766 DATA224,5,240,11,232,208,233,169,0,157,205,2,24,144,232
767 REM ****** CHECK UPRIGHTS ******
768 DATA160,2,162,1,185,120,4,201,81,208,11,192,32,240,19,189,199,2,168,232
769 DATA208,238,169,0,157,205,2,202,157,205,2,232,208,233
770 DATA160,2,162,1,185,160,4,201,81,208,11,192,32,240,19,189,199,2,168,232
771 DATA208,238,169,0,157,205,2,202,157,205,2,232,208,233
772 REM ***** CHECK BLOCKS 6-10 *****
773 DATA160,2,162,1,185,200,4,201,81,208,16,152,221,199,2,240,3,200,208,240
774 DATA224,5,240,11,232,208,233,169,0,157,211,2,24,144,232
775 REM ****** CHECK BOTTOM LINE ******
776 DATA160,2,162,1,185,64,5,201,81,208,16,152,221,199,2,240,3,200,208,240
777 DATA224,5,240,11,232,208,233,169,0,157,211,2,24,144,232
778 REM ****** CHECK UPRIGHTS ******
779 DATA160,2,162,1,185,240,4,201,81,208,11,192,32,240,19,189,199,2,168,232
780 DATA208,238,169,0,157,211,2,202,157,211,2,232,208,233
781 DATA160,2,162,1,185,24,5,201,81,208,11,192,32,240,19,189,199,2,168,232
782 DATA208,238,169,0,157,211,2,202,157,211,2,232,208,233
783 REM ***** CHECK BLOCKS 11-15 *****
784 DATA160,2,162,1,185,64,5,201,81,208,16,152,221,199,2,240,3,200,208,240
785 DATA224,5,240,11,232,208,233,169,0,157,217,2,24,144,232
786 REM ****** CHECK BOTTOM LINE ******
787 DATA160,2,162,1,185,184,5,201,81,208,16,152,221,199,2,240,3,200,208,240
788 DATA224,5,240,11,232,208,233,169,0,157,217,2,24,144,232
789 REM ****** CHECK UPRIGHTS ******
790 DATA160,2,162,1,185,104,5,201,81,208,11,192,32,240,19,189,199,2,168,232
791 DATA208,238,169,0,157,217,2,202,157,217,2,232,208,233
792 DATA160,2,162,1,185,144,5,201,81,208,11,192,32,240,19,189,199,2,168,232
793 DATA208,238,169,0,157,217,2,202,157,217,2,232,208,233
794 REM ***** CHECK BLOCKS 16-20 *****
795 DATA160,2,162,1,185,184,5,201,81,208,16,152,221,199,2,240,3,200,208,240
796 DATA224,5,240,11,232,208,233,169,0,157,223,2,24,144,232
797 REM ****** CHECK BOTTOM LINE ******
798 DATA160,2,162,1,185,48,6,201,81,208,16,152,221,199,2,240,3,200,208,240
799 DATA224,5,240,11,232,208,233,169,0,157,223,2,24,144,232
800 REM ****** CHECK UPRIGHTS ******
801 DATA160,2,162,1,185,224,5,201,81,208,11,192,32,240,19,189,199,2,168,232
802 DATA208,238,169,0,157,223,2,202,157,223,2,232,208,233
803 DATA160,2,162,1,185,8,6,201,81,208,11,192,32,240,19,189,199,2,168,232
804 DATA208,238,169,0,157,223,2,202,157,223,2,232,208,233
805 REM ***** CHECK BLOCKS 21-25 *****
806 DATA160,2,162,1,185,48,6,201,81,208,16,152,221,199,2,240,3,200,208,240
807 DATA224,5,240,11,232,208,233,169,0,157,229,2,24,144,232
808 REM ****** CHECK BOTTOM LINE ******
809 DATA160,2,162,1,185,168,6,201,81,208,16,152,221,199,2,240,3,200,208,240
810 DATA224,5,240,11,232,208,233,169,0,157,229,2,24,144,232
811 REM ****** CHECK UPRIGHTS ******
812 DATA160,2,162,1,185,88,6,201,81,208,11,192,32,240,19,189,199,2,168,232
813 DATA208,238,169,0,157,229,2,202,157,229,2,232,208,233
814 DATA160,2,162,1,185,128,6,201,81,208,11,192,32,240,19,189,199,2,168,232
815 DATA208,238,169,0,157,229,2,202,157,229,2,232,208,233
816 REM ***** CHECK BLOCKS 26-30 *****
817 DATA160,2,162,1,185,168,6,201,81,208,16,152,221,199,2,240,3,200,208,240
818 DATA224,5,240,11,232,208,233,169,0,157,235,2,24,144,232
819 REM ****** CHECK BOTTOM LINE ******
820 DATA160,2,162,1,185,32,7,201,81,208,16,152,221,199,2,240,3,200,208,240
821 DATA224,5,240,11,232,208,233,169,0,157,235,2,24,144,232
822 REM ****** CHECK UPRIGHTS ******
823 DATA160,2,162,1,185,208,6,201,81,208,11,192,32,240,19,189,199,2,168,232
824 DATA208,238,169,0,157,235,2,202,157,235,2,232,208,233
825 DATA160,2,162,1,185,248,6,201,81,208,11,192,32,240,19,189,199,2,168,232
826 DATA208,238,169,0,157,235,2,202,157,235,2,232,208,233
827 REM ***** CHECK BLOCKS 31-35 *****
828 DATA160,2,162,1,185,32,7,201,81,208,16,152,221,199,2,240,3,200,208,240
829 DATA224,5,240,11,232,208,233,169,0,157,241,2,24,144,232
830 REM ****** CHECK BOTTOM LINE ******
831 DATA160,2,162,1,185,152,7,201,81,208,16,152,221,199,2,240,3,200,208,240
832 DATA224,5,240,11,232,208,233,169,0,157,241,2,24,144,232
833 REM ****** CHECK UPRIGHTS ******
834 DATA160,2,162,1,185,72,7,201,81,208,11,192,32,240,19,189,199,2,168,232
835 DATA208,238,169,0,157,241,2,202,157,241,2,232,208,233
836 DATA160,2,162,1,185,112,7,201,81,208,11,192,32,240,19,189,199,2,168,232
837 DATA208,238,169,0,157,241,2,202,157,241,2,232,208,233
838 REM *** CHECK BLOCK ALGORYTHM ***
839 DATA169,1,72,72,169,0,72,72,104,168,185,240,2,45,255,2,208,1,8,104,168
840 DATA185,206,2,201,1,208,122,172,254,207,173,255,2,24,121,240,2,153,240,2
841 DATA104,170,104,168,24,32,240,255,169,158,32,210,255,169,18,32,2,0,255
842 DATA169,32,32,210,255,32,210,255,32,210,255,32,210,255,32,210,255
843 DATA232,24,32,240,255,169,32,32,210,255,32,2,0,255,32,210,255,32,210,255
844 DATA32,210,255,169,146,32,210,255,192,27,208,1,202,152
845 DATA201,27,240,45,24,105,6,72,202,138
846 DATA72,238,255,207,173,255,207,72,14,255,2,173,254,207,72,76,221,198
847 DATA104,104,170,104,168,192,27,240,1,232,24,144,214,104,170,104,168,192,27
848 DATA240,1,232,24,144,202
849 DATA169,3,72,138,201,21,240,29,24,105,3,72,238,255,207,238,255,207,173,255
850 DATA207,72,238,254,207,173,254,207,72,169,1,141,255,2,76,221,198,104,169
851 DATA1,141,255,2,169,0,141,255,207,141,254,207,32,0,201,32,0,203,32,0,205
852 DATA133,163,201,1,208,1,96,173,30,208,41,1,240,1,96,76,0,206,-1
859 REM ***** MONSTER MOVE *******
860 DATA173,2,208,160,0,56,233,8,144,3,200,208,248,136,192,2,48,3,24,144,5
861 DATA152,24,105,32,168,140,252,207
862 DATA173,3,208,162,0,56,233,8,144,3,232,208,248,202,202,202,202,202,142,253
863 DATA207
864 DATA173,253,207,197,253,240,54,197,253,48,25
865 DATA160,0,173,2,208,217,188,2,240,8,200,192,7,208,246,76,0,202,169,3,133
866 DATA255,76,0,202
867 DATA160,0,173,2,208,217,188,2,240,8,200,192,7,208,246,76,0,202,169,4,133
868 DATA255,76,0,202
869 DATA173,252,207,197,252,48,25
870 DATA160,0,173,3,208,217,167,2,240,8,200,192,8,208,246,76,0,202,169,1,133
871 DATA255,76,0,202
872 DATA160,0,173,3,208,217,167,2,240,8,200,192,8,208,246,76,0,202,169,2,133
873 DATA255,76,0,202,-1
874 DATA165,255,201,1,208,38,201,2,240,56,201,3,240,11
875 DATA173,3,208,201,228,240,3,238,3,208,96
876 DATA173,3,208,201,62,240,3,206,3,208,96
877 DATA173,2,208,201,36,208,7,173,16,208,41,2,240,15,56,206,2,208,208,9,173,16
878 DATA208,73,2,141,16,208,24,96
879 DATA173,2,208,201,12,208,7,173,16,208,41,2,208,15,24,238,2,208,208,9
880 DATA173,16,208,73,2,141,16,208,24,96,-1
900 REM ******* MONSTER #2 MOVE *******
910 T=0:C=0
920 READA:IFA=-1THENT=255:READA:C=C+1:IFC=2THENRETURN
930 POKE52464+T,A:T=T+1:GOTO920
931 DATA173,4,208,160,0,56,233,8,144,3,200,208,248,136,192,2,48,3,24,144,5
932 DATA152,24,105,32,168,140,250,207
933 DATA173,5,208,162,0,56,233,8,144,3,232,208,248,202,202,202,202,202,142,251
934 DATA207
935 DATA173,251,207,197,253,240,54,197,253,48,25
936 DATA160,0,173,4,208,217,188,2,240,8,200,192,7,208,246,76,0,204,169,3,133
937 DATA164,76,0,204
938 DATA160,0,173,4,208,217,188,2,240,8,200,192,7,208,246,76,0,204,169,4,133
939 DATA164,76,0,204
940 DATA173,250,207,197,252,48,25
941 DATA160,0,173,5,208,217,167,2,240,8,200,192,8,208,246,76,0,204,169,1,133
942 DATA164,76,0,204
943 DATA160,0,173,5,208,217,167,2,240,8,200,192,8,208,246,76,0,204,169,2,133
944 DATA164,76,0,204,-1
945 DATA165,164,201,1,240,38,201,2,240,56,201,3,240,11
946 DATA173,5,208,201,228,240,3,238,5,208,96
947 DATA173,5,208,201,62,240,3,206,5,208,96
948 DATA173,4,208,201,30,208,7,173,16,208,41,4,240,15,56,206,4,208,208,9,173,16
949 DATA208,73,4,141,16,208,24,96
950 DATA173,4,208,201,17,208,7,173,16,208,41,4,208,15,24,238,4,208,208,9
951 DATA173,16,208,73,4,141,16,208,24,96,-1
960 FORT=0TO5:X=0
962 READA:IFA=-1THEN[illegible]
984 POKE51456+T*256+X,A:X=X+1:GOTO962
986 NEXT:RETURN
987 DATA160,0,132,163,185,206,2,201,1,208,38,200,192,5,240,29,192,11,240,25
988 DATA192,17,240,21,192,23,240,17,192,29,240,13,192,35,240,9,192,41,238,220
989 DATA169,1,133,163,96,200,208,212,-1
990 DATA173,32,3,41,1,240,3,32,0,200,173,52,3,41,2,240,3,32,0,232,76,0,192,-1
1000 PRINT"":PRINT
1010 PRINT"  -------------------------------"
1020 PRINT"  GOLD   GOLD   GOLD   GOLD   GOLD  "
1030 PRINT"  BARS   BARS   BARS   BARS   BARS  "
1040 PRINT"  -------------------------------"
1050 PRINT"  GOLD   GOLD   GOLD   GOLD   GOLD  "
1060 PRINT"  BARS   BARS   BARS   BARS   BARS  "
1070 PRINT"  -------------------------------"
1080 PRINT"  GOLD   GOLD   GOLD   GOLD   GOLD  "
1090 PRINT"  BARS   BARS   BARS   BARS   BARS  "
1100 PRINT"  -------------------------------"
1110 PRINT"  GOLD   GOLD   GOLD   GOLD   GOLD  "
1120 PRINT"  BARS   BARS   BARS   BARS   BARS  "
1130 PRINT"  -------------------------------"
1140 PRINT"  GOLD   GOLD   GOLD   GOLD   GOLD  "
1150 PRINT"  BARS   BARS   BARS   BARS   BARS  "
1160 PRINT"  -------------------------------"
1170 PRINT"  GOLD   GOLD   GOLD   GOLD   GOLD  "
1180 PRINT"  BARS   BARS   BARS   BARS   BARS  "
1190 PRINT"  -------------------------------"
1200 PRINT"  GOLD   GOLD   GOLD   GOLD   GOLD  "
1210 PRINT"  BARS   BARS   BARS   BARS   BARS  "
1220 PRINT"  -------------------------------"
1250 RETURN
1499 REM ****** SOUND FOR KILLED ******
1500 POKEWH,0:POKE54296,15:POKEAD,12:POKESR,0:POKEWH,129:POKEHI,36:POKELO,85
1505 FORT=1TO15:POKE53281,T:FORR=1TO100:NEXTR,T:POKE53281,11
1510 FORT=1TO1500:NEXT:POKE54296,0:RETURN
1549 REM ***** GAME OVER *********
1550 CR=(SR-1)*25:FORT=718TO758
1560 IFT=723ORT=729ORT=735ORT=741ORT=747ORT=753THEN1580
1570 IFPEEK(T)=0THENCR=CR+1
1580 NEXT
1585 POKE198,0
1590 IFCR<SC(10)ORCR=0THEN1680
1600 POKE53280,0:POKE53281,0:PRINT"TYPE IN YOUR NAME"
1610 PRINT"AND PRESS RETURN PLEASE"
1620 PRINT"":INPUTN$:SN$(10)=N$:SC(10)=CR
1630 C=0:FORT=1TO9
1640 IFSC(T+1)>SC(T)THENQ=SC(T+1):SC(T+1)=SC(T):SC(T)=Q:GOTO1670
1650 NEXT:IFC=1THEN1630
1660 GOTO1680
1670 [illegible]:C=1:GOTO1650
1680 POKE53280,0:POKE53281,0
1690 PRINT"****** TOP TEN ALL TIME BEST ******"
1700 PRINT""
1710 FORT=1TO10:PRINT"";T;"";SN$(T);TAB(25)SC(T):NEXT
1720 PRINT"****** HIT A KEY TO CONTINUE ******"
1730 GETA$:IFA$=""THEN1730
1740 GOTO8
1999 REM ******* INSTRUCTIONS *******
2000 PRINT"":POKE53280,0:POKE53281,0:FORT=1024TO1063:POKET+54272,0:POKET,42:NEXT
2010 FORT=1103TO2023STEP40:POKET+54272,0:POKET,42:NEXT
2020 FORT=2022TO1984STEP-1:POKET+54272,0:POKET,42:NEXT
2030 FORT=1944TO1064STEP-40:POKET+54272,0:POKET,42:NEXT
2040 PRINT"**** INSTRUCTIONS ****"
2050 PRINT"YOU HAVE BEEN GIVEN A PIRATES"
2060 PRINT"TREASURE MAP."
2070 PRINT"IN THIS GAME YOU HAVE TO COLLECT THE"
2080 PRINT"GOLD IN YOUR TREASURE CHEST"
2090 PRINT"TO DO THIS YOU MUST SURROUND EACH"
2100 PRINT"GOLD BAR WITH YOUR FOOT STEPS."
2110 PRINT"MEANWHILE..."
2120 PRINT"THE PIRATES ARE OUT TO RECLAIM THEIR"
2130 PRINT"TREASURE MAP AND TO KILL YOU AS WELL"
2140 PRINT"[illegible]"
2150 PRINT"YOU ARE THE TREASURE CHEST."
2160 PRINT"YOU HAVE THREE LIVES TO COLLECT AS"
2170 PRINT"MANY GOLD BARS AS POSSIBLE."
2180 PRINT"THE CONTROLS ARE :-"
2190 PRINT"F1  TO GO UP."
2200 PRINT"F3  TO GO DOWN."
2210 PRINT"F5  TO GO LEFT."
2220 PRINT"F7  TO GO RIGHT."
2230 PRINT"HIT ANY KEY TO CONTINUE!"
2240 [illegible]
2250 RETURN
```



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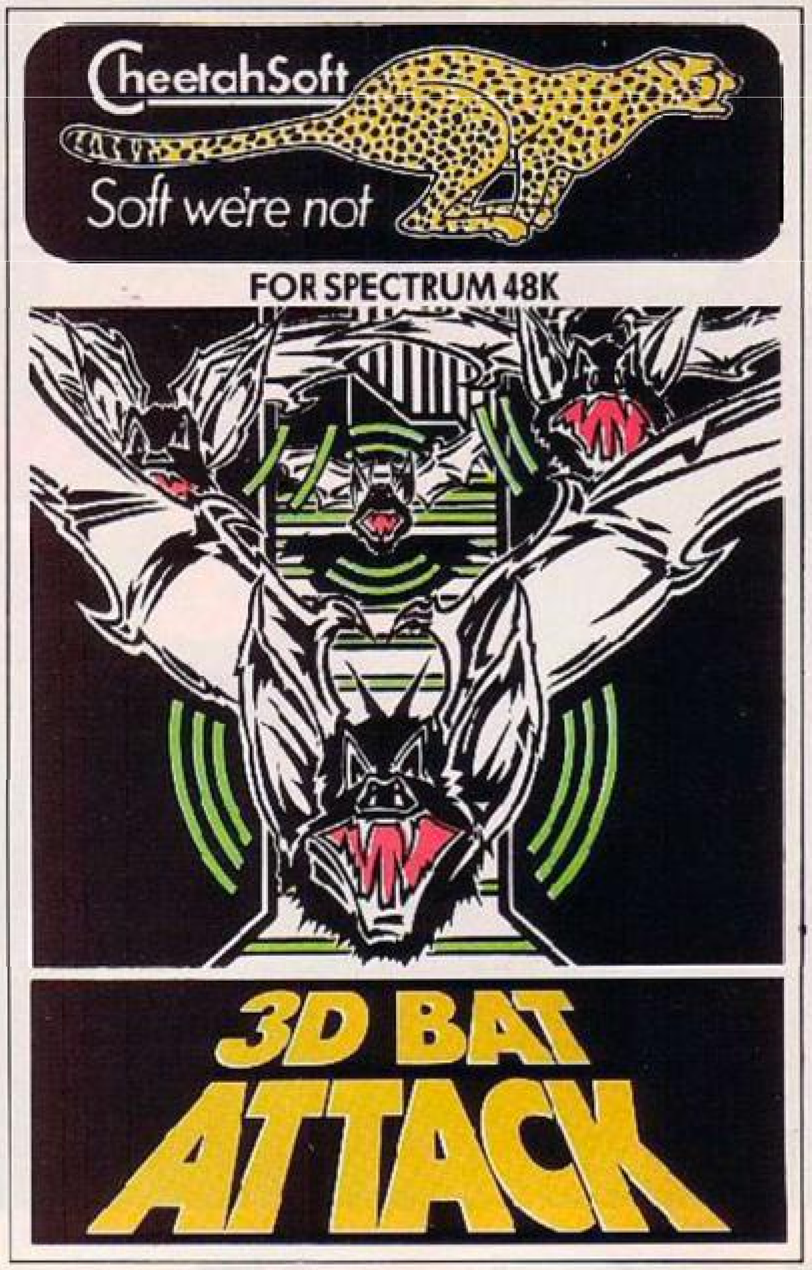
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IDEAL IDEAL is an Interrupt Driven Extendible Animation sub Language. Once you have mastered IDEAL's easy to learn set of over 80 commands and just a little FORTH, you will be ready to produce arcade-quality games even if you don't know machine code. Up to 255 Sprites, each with its own user-defined dimensions can be moved around the screen (or memory), scrolled, spun, reflected enlarged or inverted with amazing speed and smoothness. Operations are possible between screen windows, Sprites and Sprite windows. Sprites can even stretch across several screens, so those difficult scrolling landscapes that form the basis of so many games are easy to achieve. Sinclair's own sound and graphics commands such as CIRCLE DRAW and BEEP are fully supported, and there are some unique collision detection facilities.

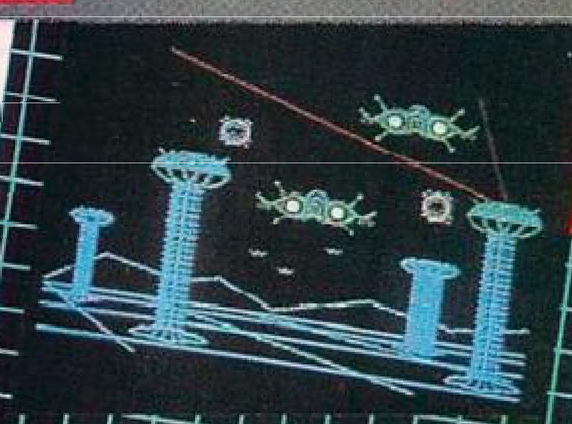
MULTI-TASKING Because **White Lightning** uses interrupts, you can effectively run two programs at once. This means of course, that games like Space Invaders and Defender can be written without complex timing calculations. So while one program smoothly scrolls the landscape, the second animates the other characters. This is undoubtedly one of White Lightning's most powerful features.





- Produces real machine code programs which run independently of White Lightning.
- A multi-tasking animation language AND a Sprite Development program together in one system-pack.

WHITE LIGHTNING



- Supplied with a FREE 16-minute demo, and a 130-page, easy-to-follow manual.



MARKETING AND PORTABILITY Although **White Lightning** uses an integer FORTH as its host language, programs can be written in a combination of BASIC, FORTH, IDEAL and machine language.

What is more, programs written in FORTH/IDEAL will be highly portable between the Spectrum and implementations under development for other popular micros.

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SPRITE DESIGN White Lightning, comes complete with a separate 20K program for developing the Sprites used in the main system. Not only can you use this to design your own Sprites from scratch, it also comes complete with 168 pre-defined characters covering games like **Asteroids, Pac-Man, Assault Course, Defender, Space Invaders, City Bomber, Lunar Lander, Frogger, Centipede, Donkey Kong** and many, many, more. These characters are ready to use or can be enhanced. And Sprites can be saved to tape between editing sessions before being finally loaded into the main program.



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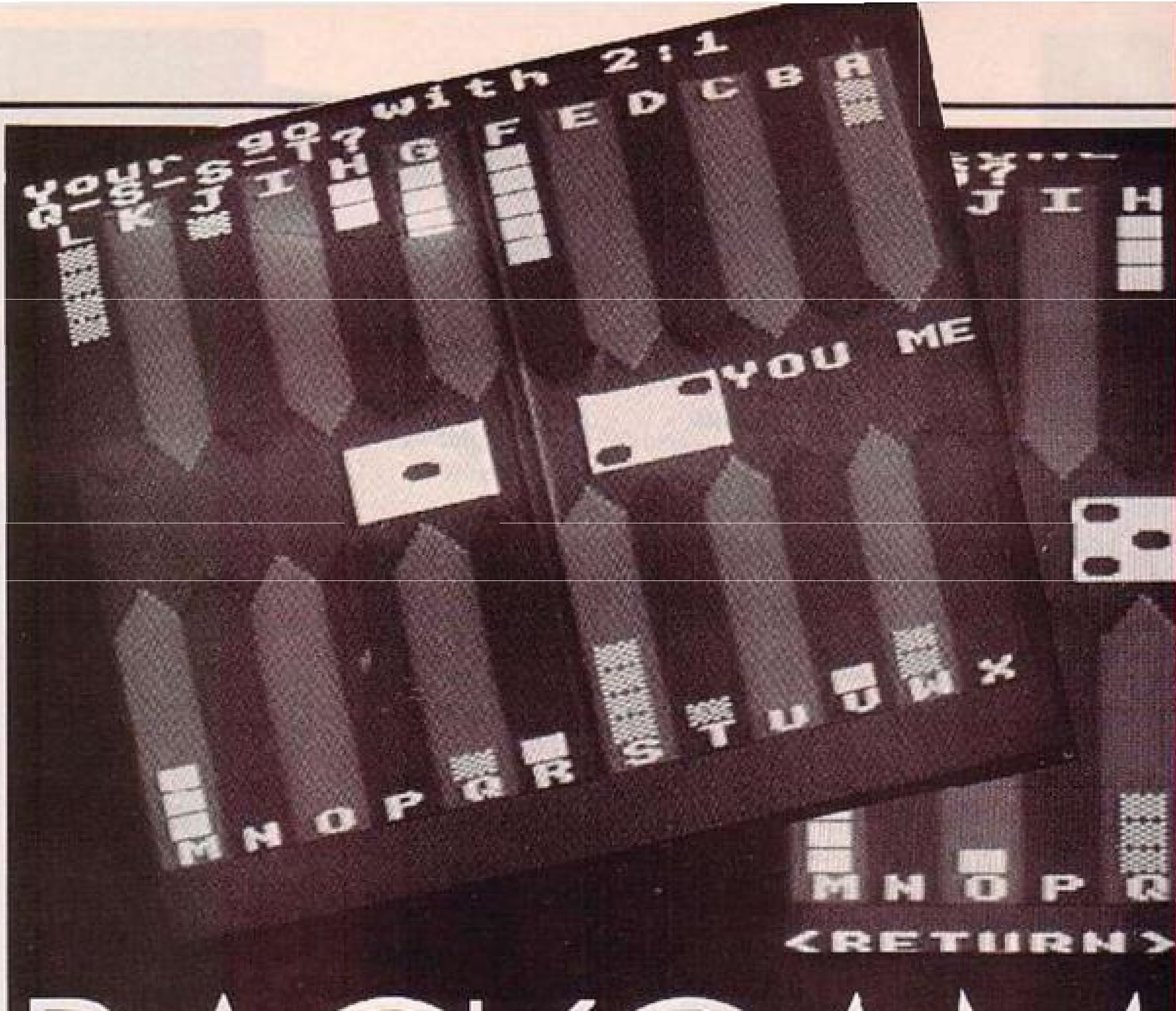
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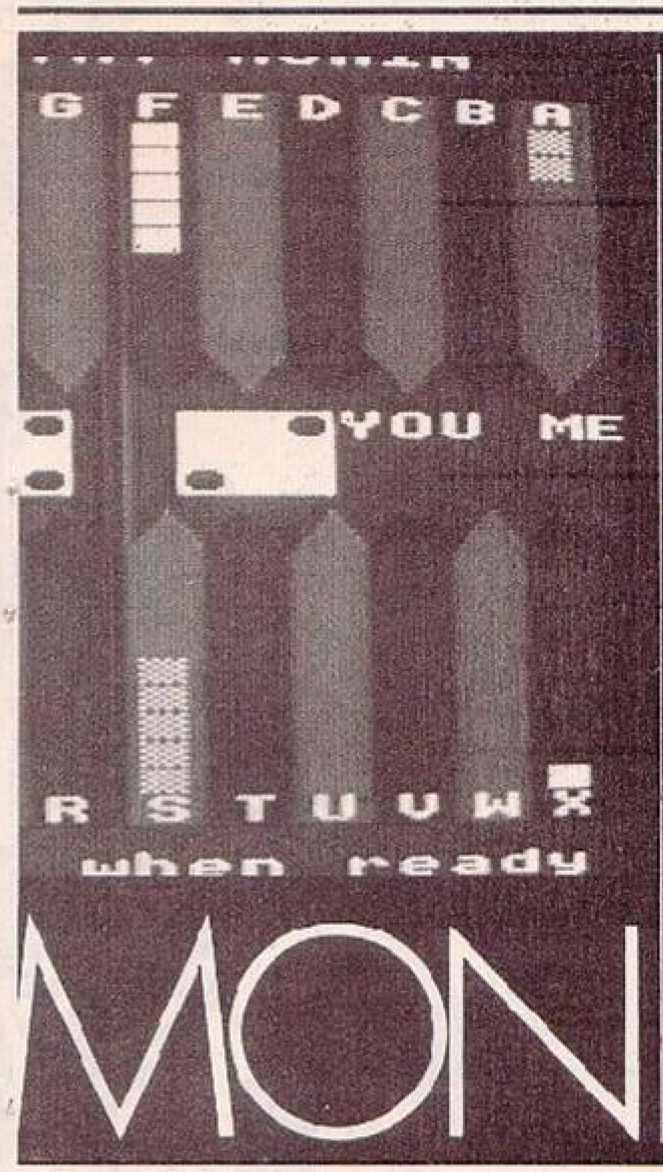
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YC9



BACKGAM

```
10MODE4:PROCIN
20DIMA%(30),C%(30),E%(30),D%(2),B%(4,2),E(2),A$(5):PROCCH:PROCSG:ME=0:YOU=0:*TV255
30MODE5:PROCCRS:PRINT"BACKGAMMON.":INPUT''"Game level 1-6 ",lv:IFlv>6 lv=6
40PROCCI:VDU28,0,31,19,1,12,26:PROCBD:FORL%=1TO24:PROCP:NEXT:PROCB:I%=RND(20):gm=-1
50PROCDI:IFD%(1)=D%(2) PROCDSD:GOTO50
60db=1:IFD%(1)<D%(2) I%=D%(1):D%(1)=D%(2):D%(2)=I%:db=-1:GOTO180
70PROCC:PRINT"My go with ";D%(1);":";D%(2):PROCbbc:PROCC:PRINT"MY MOVES-":FORI%=1TOM:IFB%(I%,1)=0ANDB%(I%,2)=0 PRINT"0:0 ";:GOTO110
80IFB%(I%,1)=25 PRINTCHR$228":"CHR$(64+B%(I%,2))" ";:GOTO110
90IFB%(I%,2)=0 PRINTCHR$(64+B%(I%,1))":"CHR$227" ";:GOTO110
100PRINTCHR$(64+B%(I%,1))":"CHR$(64+B%(I%,2))" ";
110NEXT:PROCMP:PROCR:IFA%(27)=15 X=1:GOTO290
120gm=1:IFdb>0 PROCC:GOTO170
130IFd=64THEN170ELSEPROCDBC:IFA$<>"D"THEN170
140PROCG:PROCC:IF gm=1THEN160
150PROCDR:GOTO330
160db=1:PROCAD:PROCDSD
170PROCDI
180PROCC:PRINT"Your go with ";D%(1);":";D%(2):PROCLG:IFgm<>1 VDU7:PRINTTAB(0,0)"ILLEGAL-TRY AGAIN":PROCR:GOTO180
190PROCC:PRINT"YOUR MOVES-":FORI%=1TOM:IFB%(I%,1)=0ANDB%(I%,2)=0 PRINT"0:0 ";:GOTO230
200IFB%(I%,1)=0 PRINTCHR$228":"CHR$(64+B%(I%,2))" ";:GOTO230
210IFB%(I%,2)=25 PRINTCHR$(64+B%(I%,1))":"CHR$227" ";:GOTO230
220PRINTCHR$(64+B%(I%,1))":"CHR$(64+B%(I%,2))" ";
230NEXT:PROCMP:IFA%(28)=-15 PROCC:X=0:GOTO290
240PROCR:PROCC:gm=1:IFdb<0THEN280
250IFd=64THEN280ELSEPROCDY:IFgm=0THEN280
260PROCDD:IFA$="R" X=1:PROCDR:GOTO330
270db=-1:PROCAD:PROCDSD
280PROCDI:GOTO70
290gm=1:J%=19-18*X:IFA%(27+X)<>0THEN330
300gm=2:IFA%(F+X)<>0 gm=3:GOTO330
310FORI%=J%TOJ%+5:IFA%(I%)<>0 gm=3
320NEXT
330CLS:Y=gm*d:IFX=1 PRINT'"I";:ME=ME+Y:GOTO350
340PRINT'"You";:YOU=YOU+Y
350PRINT"'ve won ";Y;" unit";:IFY>1 PRINT"s."
360IFgm=2 PRINT"(GAMMON)"
370IFgm=3 PRINT"(BACKGAMMON)"
380PRINT''"My score";ME:PRINT"Your score";YOU''"Do you want another"'"game (Y/N)?";:PROCyn:CLG:GOTO30
390DEFPROCG
400gm=0:PROCRG:IFL%<50THEN420
410IFA%(29)+A%(A)<(3*L%+220)/40 gm=1:GOTO430
420PROCRT:IFP%<Q%+2 gm=1
430ENDPROC
440DEFPROCRT
450P%=0:Q%=0:FORI%=1TO24:IFA%(I%)>0 P%=P%+A%(I%)*INT((I%-1)/4+1)
460IFA%(I%)<0 Q%=Q%-A%(I%)*INT((24-I%)/4+1)
470NEXT:P%=P%+A%(F)*7:Q%=Q%-A%(26)*7
480ENDPROC
490DEFPROCBBCB
500C=1:K%=0:E(1)=K%:E(2)=K%:J%=C:IFC%(26)<0 J%=2
510FORI%=1TO24:IFC%(I%)<0 J%=2
520IFC%(I%)<=0 C=1:GOTO570
530IFJ%=2 K%=1
540IFC%(I%)=1 C=1:GOTO570
550E=h+5-I%:IF(E<1)-(E>h) E=1
560E(J%)=E(J%)+E*C:C=C+.5
570NEXT:B=E(2)+A%(A)-C%(A)+.01*(C%(27)-A%(27)):IFK%>C B=B+px*E(1)+kw
580IFB<=G THEN640
590E(1)=X:E(2)=Y:FORI%=1TOpl:IFC%(I%)<>1THEN630
600FORS=1TO2:L%=I%-6*(S-1):FORJ%=1TO6:K%=L%-J%:IFK%=C K%=-S:J%=6:S=2:GOTO620
610IFC%(K%)<C B=B-E(S)*(F-I%)
620NEXT:NEXT:IFK%<0 IFC%(26)<0 B=B-E(-K%)*(F-I%)
630NEXT
640ENDPROC
650DEFPROCRG:L%=-A%(A):IFL%>A%(29) L%=A%(29)
660ENDPROC
670DEFPROCDY:gm=0:PROCRG:IFL%>99THEN770
680J%=1:IFA%(28)<0 J%=100
690IFL%<50THEN720
700N=-A%(29)-A%(A):IF(N<(3*L%+100)/40)-(N>35*J%)THEN770
710GOTO730
720PROCRT:N=Q%-P%:IF(N<2)-(N>16*J%)THEN770
730FORI%=1TO7:J%=F-I%:IFA%(J%)>0 J%=I%:I%=7
740NEXT:IFJ%>7 gm=1:GOTO770
750K%=0:FORI%=J% TO12:J%=F-I%:IFA%(J%)<-1 K%=K%+1
760NEXT:IFK%<4 gm=1
770ENDPROC
780DEFPROCbbc:M1=1:N=0:R=1:U=0:G=-999:FORI%=1TO8:E%(I%)=U:NEXT:pl=18:h=5:px=.25:kw=U:I%=D%(1)-D%(2):IFD%(1)=D%(2) I%=I%*2
790I%=I%-A%(29)-A%(A):IF I%<(3*A%(29)+380)/40THEN810
800kw=-99:pl=13:h=1:px=1
810PROCbbcm:IFN<M1 THEN850
820U=U+1:IF(U>lv)*(N=M)THEN850
830PROCBBCB:IF(B<=G)*(N=M1)THEN810
840G=B:M1=N:FORI%=1TOM:E%(I%)=B%(I%,1):E%(I%+4)=B%(I%,2):NEXT:GOTO810
850FORI%=1TOM:B%(I%,1)=E%(I%):B%(I%,2)=E%(I%+4):NEXT
860FORI%=1TOA:C%(I%)=A%(I%):NEXT:KP=1:FORI%=1TOM:A1=B%(I%,1):A2=B%(I%,2):PROCM:NEXT:FORI%=1TOP:A%(I%)=C%(I%):NEXT
870ENDPROC
880DEFPROCbbcm:IFN>0THEN1130
890R=1
900N=1:Q%=24:FORI%=1TOA:C%(I%)=A%(I%):NEXT
910S1=Q%:IT=D%(R):IFN<>1 IT=D%(3-R)
920IFC%(F)=0THEN950
930K%=F-IT:IFC%(K%)<-1THEN1100
940B%(N,1)=F:B%(N,2)=K%:GOTO1080
950P%=0:FORJ%=S1 TO1STEP-1:Q%=J%:IFC%(J%)<=0THEN980
960K%=J%-IT:IFK%<=0 P%=1:J%=1:GOTO980
970IFC%(K%)>=-1 P%=2:J%=1
980NEXT
990IFP%=0THEN1100
1000IFP%=1THEN1020
1010B%(N,1)=Q%:B%(N,2)=K%:GOTO1080
1020IFK%=0 K%=7
1030IFK%<0 K%=Q%+1
1040P%=0:FORI%=K% TO24:IFC%(I%)>0 P%=1:I%=24
1050NEXT
1060IFP%=1THEN1100
1070B%(N,1)=Q%:B%(N,2)=0
1080A1=B%(N,1):A2=B%(N,2):KP=1:PROCM:IFN=M THEN1230
1090N=N+1:GOTO910
1100IFN>M1 THEN1220
1110IFN=1THEN1190
1120N=N-1
1130IFB%(N,1)=F THEN1190
1140IFB%(N,2)=0THEN1110
1150S1=B%(N,1)-1:IFS1<=0THEN1110
1160FORI%=1TOA:C%(I%)=A%(I%):NEXT:IT=D%(R):IFN<>1 IT=D%(3-R)
1170K%=N-1:IFK%=0THEN950
1180KP=1:FORI%=1TOK%:A1=B%(I%,1):A2=B%(I%,2):PROCM:NEXT:GOTO950
1190IF(M=4)-(R=2)THEN1210
1200R=2:GOTO900
1210N=1
1220FORI%=N TOM:B%(I%,1)=0:B%(I%,2)=0:NEXT:N=N-1
1230ENDPROC
1240DEFPROCM:IFA1=A2 THEN1320
1250L%=(59-KP)/2:C%(L%)=C%(L%)+A2-A1:IFA1=0 C%(26)=C%(26)+1:GOTO1290
1260IFA1=F C%(F)=C%(F)-1:GOTO1280
1270C%(A1)=C%(A1)-KP
1280IFA2=0 C%(27)=C%(27)+1:GOTO1320
1290IFA2=F C%(28)=C%(28)-1:GOTO1320
1300IFC%(A2)<>-KP C%(A2)=C%(A2)+KP:GOTO1320
1310C%(A2)=KP:L%=55-L%:C%(L%)=C%(L%)-KP:L%=4+L%:C%(L%)=C%(L%)-A2:IFL%=29 C%(L%)=C%(L%)+F
1320ENDPROC
1330DEFPROCLG:FORI%=1TOM:B%(I%,1)=0:B%(I%,2)=0:NEXT
1340B$=""
1350*FX4,1
1360PROCGT:*FX4,0
1370IFASC(A$)=13 VDU26:GOTO1450
1380IFASC(A$)=127 PRINTL$"  "L$L$;:A$="":GOTO1460
1390I%=ASC(A$)-64:IFI%=75 I%=25:A$=CHR$227
1400IFI%=74 I%=0:A$=CHR$228
1410IF(I%>-1)*(I%<26) Z$=STR$I%:GOTO1430
1420Z$="-"
1430B$=B$+Z$
1440PRINTA$;:GOTO1350
1450PRINT:GOTO1510
1460B=LENB$:IFRIGHT$(B$,1)="-" B=LEN(B$)-1:GOTO1480
1470IFI%>9 B=LEN(B$)-2ELSEB=LEN(B$)-1
1480IFB<=0 PRINTTAB(0,1)A$;:GOTO1340
1490IFB<1THEN1350
1500B$=LEFT$(B$,B):GOTO1440
1510B=LEN(B$):K%=0:L%=1:FORI%=1TOM:FORJ%=1TO2
1520K%=K%+1:IFK%>B I%=M:J%=2:GOTO1570
1530A$=MID$(B$,K%,1):IFA$<>"-"THEN1560
1540IFL%=1THEN1570
1550L%=1:GOTO1570
1560B%(I%,J%)=B%(I%,J%)*10+VALA$:L%=0:GOTO1520
1570NEXT:NEXT:gm=0:FORI%=1TOA:C%(I%)=A%(I%):NEXT:E(1)=D%(1):E(2)=D%(2):FORI%=1TOM:M1=B%(I%,1):M2=B%(I%,2):IFM1<>M2 THEN1720
1580IFI%<>1THEN1630
1590K%=D%(1):PROCOK:IFgm=0THEN1970
1600IFD%(1)=E%(2)THEN1680
1610K%=D%(2):PROCOK:IFgm=1THEN1680
1620GOTO1970
```



BACKGAMMON ENABLES the user to play against the computer and instructions are included within the program. Briefly, the program plays the traditional rules of backgammon, including the use of a doubling cube. The points are labelled alphabetically from A to X. The dice are shown graphically as is whether the player or the computer has the doubling cube.

Moves are made by entering two pairs of information comprising the point from which a piece is to be moved and the destination point for each dice.

For example, a six and three are thrown. To move a piece six places from the C point and a piece three pieces from the F point type C:I F:I. To move the piece the full nine places of the throw type C:I I:L. To return from the bar use the down arrow key as the point references. To bear off use the up arrow key as the destination.

The player must use both throws of the dice if at all possible. If this is not possible simply press Return after entering the move possible — if any can be made.

The program checks for legal moves and will not allow the player to cheat. The computer plays a strong game and on the lower levels will enable the novice to become familiar with backgammon. On the higher levels it presents a challenge for even the experienced player.

The program itself is written in compressed form. ■

```
1630K%=D%(3-J%):PROCOK:IFgm=0THEN1970
1640IFD%(3-J%)>=D%(J%)THEN1670
1650K%=D%(J%):FORL%=1TOA:E%(L%)=C%(L%):
C%(L%)=A%(L%):NEXT:PROCOK:FORL%=1TOA:C%(
L%)=E%(L%):NEXT:IFgm=1THEN1980
1660GOTO1970
1670IFI%=1 THEN1980
1680gm=0:J%=I%+1:R=0:FORK%=J% TOM:IFB%(
K%,1)<>B%(K%,2) R=1:K%=M
1690NEXT
1700IFR=1THEN1970
1710GOTO1980
1720IF(M1<0)-(M1>24)THEN1970
1730IF(M2<1)-(M2>F)THEN1970
1740IFM1<>0THEN1800
1750IFC%(26)>=0THEN1970
1760J%=0:FORK%=1TO2:IFM2=D%(K%) J%=K%
1770NEXT:IFJ%=0THEN1970
1780K%=C%(M2):IFK%>1THEN1970
1790GOTO1950
1800IF(C%(26)<0)-(C%(M1)>=0)THEN1970
1810IFM2=F THEN1860
1820J%=C%(M2):IFJ%>1THEN1970
1830R=M2-M1:IFR=D%(1) J%=1:GOTO1950
1840IFR=D%(2) J%=2:GOTO1950
1850GOTO1970
1860R=F-M1:S=0:FORK%=1TO2:J%=3-K%:IFR<=
D%(J%) S=1:K%=2
1870NEXT
1880IFS=0THEN1970
1890FORK%=1TO18:IFC%(K%)<0 S=0:K%=18
1900NEXT
1910IFS=0THEN1970
1920IFR=D%(J%)THEN1950
1930K%=M1-1:FORL%=19TOK%:IFC%(L%)<0 S=0
:L%=K%
1940NEXT:IFS=0THEN1970
1950A1=M1:A2=M2:KP=-1:PROCH:IFM=2 D%(J%
)=0
1960GOTO1990
1970gm=2
1980I%=M
1990NEXT
2000IFgm=2 D%(1)=E(1):D%(2)=E(2):GOTO20
20
2010gm=1:FORI%=1TOA:A%(I%)=C%(I%):NEXT
2020ENDPROC
2030DEFPROCOK:gm=0:IFC%(26)=0THEN2060
2040IFC%(K%)<2THEN2180
2050GOTO2160
2060S=0:FORL%=1TO24:IFC%(L%)>=0THEN2090
2070KP=L%-K%:IFKP>24 S=L%:L%=24:GOTO209
0
2080IFC%(KP)<1 S=-1:L%=24
2090NEXT
2100IFS=0THEN2160
2110IFS=-1THEN2180
2120IFKP=F KP=18
2130IFKP>F KP=S-1
2140S=0:FORL%=1TOKP:IFC%(L%)<0 S=1:L%=K
P
2150NEXT:IFS=0THEN2180
2160gm=1
2170ENDPROC
2180DEFPROCP
2190IF(L%=0)-(L%=F)THEN2320
2200VDU5,30:J%=A%(L%):P%=ABS(J%)
2210IFL%>12 D%=295:A%=((L%-12)*100)-60:
MOVEA%,D%:GOTO2230
2220D%=793:A%=((13-L%)*100)-60:MOVEA%,D
%
2230IF(L%>18)-(L%<7) A%=A%+20:MOVEA%,D%
2240FORK%=5TO1STEP-1:IFP%<K% PROCCR:PRI
NTS$:GCOLO,0:D%=D%+32:MOVEA%,D%:GOTO2300
2250IF(J%>=K%)*(K%<5) PROCCR:PRINTS$:MO
VEA%,D%:GCOLO,3:PRINTM$:D%=D%+32:MOVEA%,
D%:GOTO2300
2260IF(J%<=-K%)*(K%<5) PROCCR:PRINTS$:M
OVEA%,D%:GCOLO,3:PRINTY$:D%=D%+32:MOVEA%
,D%:GOTO2300
2270IFJ%=K% PROCCR:PRINTS$:MOVEA%,D%:GC
OLO,3:PRINTM$:D%=D%+32:MOVEA%,D%:GOTO230
0
2280IFJ%=-K% PROCCR:PRINTS$:MOVEA%,D%:G
COLO,3:PRINTY$:D%=D%-32:MOVEA%,D%:GOTO23
00
2290PROCCR:PRINTS$:MOVEA%,D%:GCOLO,3:PR
INTRIGHT$(STR$(P%),1):D%=D%+32:MOVEA%,D%
2300IFL%>12 D%=D%-64:MOVEA%,D%
2310NEXT:VDU4,23,1,0;0;0;0;
2320ENDPROC
2330DEFPROCMP:FORI%=1TOM:L%=B%(I%,1):PR
OCCR:PROCP:L%=B%(I%,2):PROCCR:PROCP:NEXT
:PROCB:ENDPROC
2340DEFPROCB:PRINTTAB(0,17);:P%=7-INT(A
%(F)/2):J%=P%+A%(F):R=7-INT(-A%(26)/2):K
%=R-A%(26):PRINTU$"         "STRING$(6,L$):
FORL%=1TO15:IF(L%>P%)*(L%<=J%) PRINTU$M$
D$;
2350IF(L%>R)*(L%<=K%) PRINTU$Y$D$;
2360NEXT:PRINTD$
2370ENDPROC
2380DEFPROCAD:PROCC:PRINTTAB(0,0)"DOUBL
E ACCEPTED":ENDPROC
2390DEFPROCDSD:d=d+d:A$=RIGHT$(STR$(d),
d):PRINTTAB(15,15)"  ":IFdb>=0 PRINTTAB(
15,15)A$
2400PRINTTAB(18,15)"  ":IFdb<=0 PRINTTA
B(18,15)A$
2410PROCR:PROCC
2420ENDPROC
2430DEFPROCDBBC
2440PROCW:VDU7:PRINT"HIT <D> TO DOUBLE"
'"ELSE HIT <RETURN>":A$=GET$:PROCW:IFA$
="D" ENDPROC
2450IFASC(A$)=13 PROCC:ENDPROC
2460GOTO2440
2470DEFPROCDD
2480PROCW:VDU7:PRINT"DOUBLE? <A> - A<R>
 - refuse":A$=GET$:IFA$<>"A"ANDA$<>"R"TH
EN2480
2490PROCW:VDU26
2500ENDPROC
2510DEFPROCDR:CLS:PRINT"Double refused.
":gm=1:ENDPROC
2520DEFPROCDI:LOCAL P%,Q%,T,Z
2530P%=RND(6):Q%=RND(6):T=TIME
2540IFTIME-T>200THEN2560
2550P%=P%+1:IFP%>6 P%=1
2560Q%=Q%+1:IFQ%>6 Q%=1
2570FORZ=1TO150:NEXT
2580PRINTC$A$(P%)STRING$(2,R$)+STRING$(
2,U$)A$(Q%):IFTIME-T<350THEN2540
2590D%(1)=Q%:D%(2)=P%:IFD%(1)=D%(2) M=4
:GOTO2620
2600M=2:IFD%(2)<D%(1)THEN2620
2610IFgm>0 I%=D%(1):D%(1)=D%(2):D%(2)=I
%
2620ENDPROC
2630DEFPROCI:lv=lv*(lv+2):A=30:d=1:db=0
:X=7/18:Y=1/9:FORI%=1TOA:A%(I%)=0:NEXT:A
%(29)=167:A%(A)=-167:F=25:A%(1)=-2:A%(12
)=-5:A%(17)=-3:A%(19)=-5:A%(24)=2:A%(13)
=5:A%(8)=3:A%(6)=5:ENDPROC
2640DEFPROCED:VDU19,1,4;0;19,2,4;0;
2650col=1:GCOLO,129:MOVE20,960:FORI%=20
TO520STEP100:MOVEI%+100,960:PLOT87,I%,65
0:PLOT87,I%+100,650:PLOT87,I%+50,600:MOV
EI%+100,960:IFcol=1 col=0:GCOLO,130ELSEc
ol=1:GCOLO,129
2660NEXT:MOVE640,960:FORI%=640TO1140STE
P100:MOVEI%+100,960:PLOT87,I%,650:PLOT87
,I%+100,650:PLOT87,I%+50,600:MOVEI%+100,
960:IFcol=1 col=0:GCOLO,130ELSEcol=1:GCO
LO,129
2670NEXT:col=0:GCOLO,130:MOVE20,100:FOR
I%=20TO520STEP100:MOVEI%+100,100:PLOT87,
I%,410:PLOT87,I%+100,410:PLOT87,I%+50,46
0:MOVEI%+100,100:IFcol=1 col=0:GCOLO,130
ELSEcol=1:GCOLO,129
2680NEXT:MOVE640,100:FORI%=640TO1140STE
P100:MOVEI%+100,100:PLOT87,I%,410:PLOT87
,I%+100,410:PLOT87,I%-50,460:MOVEI%+100,
100:IFcol=1 col=0:GCOLO,130ELSEcol=1:GCO
LO,129
2690NEXT:VDU19,1,1;0;19,2,5;0;:GCOLO,12
9:MOVE620,100:PLOT7,620,960:GCOLO,130:MO
VE640,100:PLOT7,640,960:VDU5:GCOLO,3:MOV
E40,955:T%=12:FORI%=40TO540STEP100:MOVEI
%,955:PRINTCHR$(T%+64);:T%=T%-1:NEXT:MOV
E660,955
2700FORI%=660TO1160STEP100:MOVEI%,955:P
RINTCHR$(T%+64);:T%=T%-1:NEXT:MOVE40,130
:T%=13:FORI%=40TO540STEP100:MOVEI%,130:P
RINTCHR$(T%+64);:T%=T%+1:NEXT
2710MOVE660,130:FORI%=660TO1160STEP100:
MOVEI%,130:PRINTCHR$(T%+64);:T%=T%+1:NEX
T:VDU4,23,1,0;0;0;0;
2720PRINTTAB(14,14)"YOU ME"
2730DEFPROCSG:L$=CHR$8:R$=CHR$9:U$=CHR$
11:D$=CHR$10:C$=CHR$30+STRING$(14,D$)+ST
RING$(5,R$):S$=CHR$225:F$=D$+STRING$(3,L
$):M$=CHR$230:Y$=CHR$231
2740R0$=STRING$(3,CHR$225):R1$=CHR$225+
STRING$(2,CHR$225):R2$=CHR$225+CHR$226+C
HR$225:R3$=STRING$(2,CHR$225)+CHR$226:R4
$=CHR$226+CHR$225+CHR$226
2750A$(1)=R0$+F$+R2$+F$+R0$:A$(2)=R3$+F
$+R0$+F$+R1$:A$(3)=R3$+F$+R2$+F$+R1$:A$(
4)=R4$+F$+R0$+F$+R4$:A$(5)=R4$+F$+R2$+F$
+R4$:A$(6)=R4$+F$+R4$+F$+R4$
2760ENDPROC
2770DEFPROCCH:VDU23,226,255,255,255,255
,255,255,255,255,23,226,255,195,129,129,
129,129,195,255,23,230,0,254,254,254,254
,254,254,254,23,231,0,170,84,170,84,170,
84,170,23,227,16,56,124,254,56,56,56,56,
23,228,56,56,56,56,254,124,56,16
2780ENDPROC
2790DEFPROCyn
2800A$=GET$:IFA$<>"Y"ANDA$<>"N"THEN2800
2810IFA$="Y" ENDPROC ELSECLS:END
2820DEFPROCC:VDU28,0,1,19,0,12,26:ENDPR
OC
2830DEFPROCW:VDU28,0,31,19,29,12:ENDPRO
C
2840DEFPROCGT:PRINT"?"L$;:A$=GET$:ENDPR
OC
2850DEFPROCR:PROCW:VDU7:PRINT'"<RETURN>
 when ready":A$=GET$:PROCW:VDU26:ENDPROC
2860DEFPROCCRS:VDU23,1,0;0;0;0;19,2,5;0
;19,3,7;0;19,0,4;0;:ENDPROC
2870ENDPROC
2880DEFPROCCR:IFL%MOD2=0 GCOLO,1ELSEGCO
LO,2
2890ENDPROC
2900DEFPROCIN:VDU19,0,4;0;:PRINT'"BACKG
AMMON."''"  This version of the game pla
ys the"'"standard rules of Backgammon in
cluding  the use of a doubling cube whic
h you canread about in any good book on
the game."
2910PRINT'"MOVEMENT."''"  Points are na
med alphabetically. To  move from point
 A to B and from Q to U, type A-B-Q-U. T
o return from the bar"'"press the down c
ursor key, and the up"'"key to bear off.
 If you are unable to"
2920PRINT"use all your throw, press ret
urn after  you have used that part which
 you can."''"  The Computer plays a fair
 game, so if you are a novice start on t
he lower" "levels of play."' "PRESS SPAC
E TO START":A$=GET$:ENDPROC
```

Equipping the Sinclair ZX-81 with Sprite Basic means you can have fast moving graphics without soiling your hands with machine code. Malachy Devlin explains further.

SPRITE



Listing 1.

```
16514 - 8AEEF1BAF7A8B6AE = 1174      17106 - C5C122007E12E37E = 727
16522 - 747AFD1E03BFACC0 = 1209      17114 - 23E37720137EFE76 = 933
16530 - 0A2DA19813CFEF5F = 1007      17122 - 2005ED420140007E = 806
16538 - 0101119FFF0C0E0A = 722       17130 - 12E37E23E3771309 = 780
16546 - CD92020D2020CCB6 = 831       17138 - C1C50B0B0B0B0B0A = 455
16554 - 4CDD21134CD3A402 = 805       17146 - FE172005011803ED = 579
16562 - 0E7C1EC0091A1130 = 820       17154 - 427E12E37E23E377 = 844
16570 - 4BEF53B3403AB240 = 912       17162 - 13E37EFE78200601 = 801
16578 - 3A3B1403AB540232 = 708       17170 - 2000ED427E12110A = 682
16586 - B540FE00C3EDF5B3 = 1204      17178 - 77C323412AB34023 = 709
16594 - 401FFE00D1A64111 = 679       17186 - 2323237E4F237E47 = 849
16602 - 1A3C12FE00C2A241 = 858       17194 - CDEF43E50120007E = 851
16610 - 121C18121313AC0B = 687       17202 - FE002871237EFE78 = 802
16618 - 77C25742CBBF1213 = 897       17210 - 2008ED420140007E = 802
16626 - 1FF1D1A47131ABF = 677        17218 - FE00206109CDD143 = 873
16634 - 131A67CDD143C847 = 903       17226 - 13131AFE17200511 = 395
16642 - C43841CDD143C84F = 1077      17234 - 1803ED527EFE0020 = 758
16650 - C43B41CDD143C84F = 1131      17242 - 4C237EFE76200601 = 648
16658 - CCBC41CDF841CCD1 = 1177      17250 - 2000ED427EFE0020 = 747
16666 - 41CB572B5742CB5F = 1022      17258 - 3CE1CDE343112000 = 833
16674 - C4C042D31F413AB3 = 885       17266 - 0A7723037EFE7820 = 897
16682 - 4C11003019AAB340 = 391       17274 - 05ED521140000A77 = 534
16690 - 7D7E40ED4385427B = 1186      17282 - 18E0521B1B1B1B1A = 365
16698 - 84577B3BEE1F5FE5 = 1090      17290 - FE172005111803ED = 595
16706 - C17AFE1B3314CE7F = 887       17298 - 52030A7703237EFE = 532
16714 - 2003D513FE1330FA = 354       17306 - 782005112000ED52 = 523
16722 - 1530ED4457DE1B8E = 855       17314 - 0A7703B342E1CDD1 = 1203
16730 - 18E847ED5BB34013 = 917       17322 - 43CEFF12CB5F208A = 1075
16738 - 1313137912137812 = 393       17330 - CBF712ED4B5640CD = 1211
16746 - C9CB47C0ED43B640 = 1217      17338 - 8F43C3B6422A0C40 = 739
16754 - 79846779B5EF1313 = 758       17346 - 233E02B811E10023 = 371
16762 - 13137CFE1738111A = 535       17354 - 0D1810FCD91809ED = 849
16770 - CB7F2807ED441228 = 735       17362 - 5BE3421313131AC9 = 618
16778 - 001305ED44122E16 = 418       17370 - EDEB834013131312 = 646
16786 - 7CFE1F18381117CB = 707       17378 - C9ED5B53403E0683 = 873
16794 - 7F2807ED44122E00 = 543       17386 - 4FCE030A47500910 = 609
16802 - 1805ED44122E1E18 = 455       17394 - 131313C9CD8644E5 = 894
16810 - 7C121B7D12C9CB47 = 787       17402 - CDE50FCD0200E177 = 868
16818 - CBED43B640789487 = 1027      17410 - 23E5DFFE78E12860 = 1220
16826 - 79B55F131313FE1F = 707       17418 - E5E7CDE50FCD0800 = 804
16834 - 3818181B1B1ACEFF = 842       17426 - E11801237723E5E7 = 829
16842 - 121313131ACE7F28 = 471       17434 - CDE50FCDF8131E07 = 846
16850 - 042E0013022E1E7C = 275       17442 - B92E02CF1F410E00 = 544
16858 - FE1738CB1B1B1B1A = 843       17450 - 1ACE8E3C811313F8 = 584
16866 - CBFF131313131A1B = 857       17458 - E17723E5E7CDE50F = 1113
16874 - CB7F28042B001BB7 = 819       17466 - E7CDE50FCDF508E1 = 1222
16882 - 2E1813E3ED4B8610 = 820       17474 - 71237702E5E7CDE5 = 1045
16890 - CD5F43CDE343D511 = 1192      17482 - 0FE7CDE50FCDF508 = 1012
16898 - 20000AEE2204E37E = 821       17490 - E177237023E5E7CD = 1165
16906 - E37703E3E320E37E = 858       17498 - 5ECFCDF8133E04B9 = 823
16914 - FE78200BED521140 = 809       17506 - 2802CF1DE1EBEDB0 = 1151
16922 - 000A8E2004E37EE3 = 815       17514 - E1221540C9CD8644 = 953
16930 - 77031BE323E3EC5B = 984       17522 - 2323237E010000CB = 435
16938 - B6407AFE17200B11 = 893       17530 - 17CB11CB17CB11E1 = 814
16946 - 1803ED5204BE2004 = 562       17538 - 22184 0C92AB94023 = 503
16954 - E37EE37703E3E323 = 888       17546 - 2323233EFF5E2307 = 848
16962 - E37EFE7822051120 = 511       17554 - 3EEAB52802CF1C36 = 817
16970 - 00ED52CABE2004E3 = 792       17562 - EF2E3D5B1540C105 = 1085
16978 - 7EE377C1C82AB340 = 1157      17570 - C5221540CD550FCD = 827
16986 - 232323237E4F207E = 505       17578 - A220213045070707 = 188
16994 - 47CD8F43CDE34311 = 1050      17586 - 07FE55F05FF1E60F = 1303
17002 - 20007EFE0220020A = 458       17594 - 5712E5E7E1C9CD86 = 1337
17010 - 7703237EFE762006 = 803       17602 - 442323232346234E = 391
17018 - ED521140037EFE00 = 780       17610 - FA2377840E121840 = 836
17026 - 20020A7703195059 = 380       17618 - C9CD8544CDE707C3 = 1195
17034 - 1B1B1B1B1B1AFE17 = 433       17626 - C644CD230FCD8541 = 929
17042 - 2005111803ED527E = 585       17634 - C1ED431840D56268 = 1001
17050 - FE0020020A770323 = 455       17642 - 11C40019F5124440 = 418
17058 - 7EFE782005112000 = 583       17650 - 2A29400922284021 = 326
17066 - ED527EFE0220020A = 743       17658 - 2645EE5CC9508E12 = 870
17074 - 77033E0030030203 = 186       17666 - 3EE0233301232323 = 849
17082 - 02030C0234012AB3 = 685       17674 - 36EA3E7823772377 = 779
17090 - 40232323237E4F23 = 441       17682 - E12223453E0132B2 = 652
17098 - 7E470DEF43CDE343 = 1159      17690 - 40C17361CA260F3E = 678
                                     17698 - 0012130813F47800 = 442
```

Listing 2.

```
   2 REM (C) M.DEVLIN 1984
         SP. BASIC
   3 LET INIT=16524
   4 LET MOVE=16566
   5 LET SPRITE=17395
   6 LET FLAG=17519
   7 LET NUM=16552
   8 LET COORD=17600
   9 LET MOTION=17518
  10 LET DATA=17623
```

Demonstration program

```
 100 LET Z=USR DATA
 110 PRINT 250
 120 DIM A$(4,4)
 130 LET A$(1)="[illegible]"
 140 LET A$(2)="[illegible]"
 150 LET A$(3)="[illegible]"
 160 LET A$(4)="0000"
 170 LET F$="0000110"
 180 GOSUB 1000
 190 POKE NUM,5
 200 LET Z=USR MOVE
 210 IF INKEY$="" THEN GOTO 200
 215 CLS
 220 LET F$="0000101"
 230 GOSUB 1000
 240 LET Z=USR MOVE
 250 IF INKEY$="" THEN GOTO 240
 255 CLS
 260 LET C=0
 270 DIM F$(2,7)
```



MAKER

ALL BEGINNERS at computers learn to program using Basic; this is fine since it is easy to learn and easy to use. However, its real disadvantage is that it is usually slow in comparison to machine code. This means that if any fast moving graphics are required in the program then they will have to scrap the idea, or use my program which equips the ZX-81 16K with sprite Basic.

The sprite Basic can handle up to 256 sprites which can be at three levels:

- Underneath the characters
- Same level as the characters
- Over the characters.

Also when the sprite hits the edge of the screen it can either stop, bounce or wrap-round. If this sounds like what you want then roll up your sleeves and begin the hard work. First, type in

1 REM (118 characters)

followed by lines 2 to 9 which have a Rem statement containing 128 characters. Now enter:

POKE 16509,0
POKE 16510,0
POKE 16511,168
POKE 16512,4
POKE 16514,118
POKE 16515,118

You have now produced a Rem statement with 1190 characters, and when listed should appear as 0 Rem. If not then begin again. Type in the hex loader — listing 3 — and enter all the machine code in listing .

Now delete the loader and add the lines in listing 2. The complete sprite Basic has been entered. It should now be saved under an appropriate name.

In order to test the program I must explain what the sprite commands are, how to use them and their syntax. The first and longest is

Sprite: it takes the form:

LET Z = USR SPRITE

PRINT number; on or off; velocity; flag$; xcoord; ycoord; xmove; char$

Number: this is the sprite number. Range: 0 to 255.

On or Off: this is either 1 for on or 0 for off.

Velocity: this is not really the true velocity but it is the number of times the Move command is called before the sprite moves.

N.B. if velocity is zero the sprite will move with a velocity of 256. Range of velocity is 0 to 255

Flag$: this is a string which is seven characters long and consits of 0s or 1s eg., "0010110" "0010110"

This tells the computer what level the sprite is at and what it does at the edge of the screen.

If the seventh character is 1 then the sprite wraps around.

If the sixth character is 1 then the sprite bounces.

If the sixth and seventh character is a 0 then it stops at the edge of the screen; if they are both 1s then it will wrap-round.

Now let us consider the fourth and fifth characters.

If the fifth is 1 it goes under the characters. If the fourth is 1 it goes over the characters, but if they are both 0s then it travels at the same level as the characters on screen.

The third character is not used by the sprite Basic.

The second character is only used if the sprite is at the same level as the characters on the screen. If this is 1 when a sprite collides with some character on screen then it continues but if it is 0 the sprite will stop.

Finally if the first character is 1 it will remain stationary or if 0 it allows the sprite to move normally.

Xcoord: this is the initial x co-ordinate.

Ycoord: this is the initial y co-ordinate also 24 lines of screen are used.

Xmove: this is the distance the sprite will move horizontally.

Y move: same as xmove except vertically.

Char$: this is a string four characters long which contains the characters that go to make up the sprite as follows:

1 2
3 4

(continued on next page)

```
280 LET F$(1)="0000101"
290 LET F$(2)="0200110"
300 LET Z=USR SPRITE
310 PRINT C;1;1;F$(INT (RND*2)+
1);15;12;RND*3;RND*3;A$(INT (RND
*4)+1)
320 LET C=C+1
330 IF C=245 THEN GOTO 390
340 POKE NUM,C+1
345 PRINT AT 0,0;C
350 LET Z=USR MOVE
360 IF INKEY$="" THEN GOTO 350
370 IF INKEY$="0" THEN GOTO 390
380 GOTO 300
390 CLS
400 PRINT AT 10,0;"NOW FOR SOME
REAL SPEED"
410 FOR F=1 TO 100
420 NEXT F
430 POKE NUM,3
440 LET Z=USR INIT
450 STOP
1000 FOR F=0 TO 3
1010 LET Z=USR SPRITE
1020 PRINT F;1;F+1;F$;RND*32;RND
*24;RND*3;RND*3;A$(F+1)
1030 NEXT F
1040 RETURN
```



(continued from previous page)

The number represents where that character is in the string, this also means that all sprites are 2 x 2.

Note this command can be abbreviated to

LET Z = USR SPRITE

PRINT number,on or off

in order to switch sprites on or off only. This is the only possible abbreviation.

The second command is Move and takes the form:

LET Z = USR MOVE

This calls the sprite moving routine which moves sprite 0 to whatever number specified by NUM command (see next command)

Num takes the form:

POKE NUM,number of sprites + 1

Therefore to have no sprites POKE NUM,1

Flag takes the form:

LET Z = USR FLAG

PRINT number of sprite

This puts either 0,1,2 or 3 into Z, depending on the condition of the sprite.

If Z = 0 then the sprite has hit nothing and is allowed to move

Z = 1 sprite has stopped ie. if it is at the same level as characters then it has hit a character over and under sprites won't affect this flag simply because they will either go over or under the characters and can't hit them.

Z = 2 sprite has collided; if it is a same level sprite and it collides with a character on the screen then Z = 2, or if the sprite has stopped at the edge then Z = 2 but the 'stopped' flag is not set.

Z = 3 sprite has stopped and collided; see Z = 1 and Z = 2

Coord takes the form:

LET Z = USR COORD

PRINT number of sprite

This returns with Z equal to ycoordinate + 256 * xcoordinate and

PEEK 16507 = ycoordinate

PEEK 16508 = xcoordinate

of the sprite defined in the Print statement.

Motion takes the form:

LET Z = USR MOTION

PRINT number of sprite

This is the same as Coord except that the x and y movements are found.

Init takes the form:

LET Z = USR INIT

This allows the Move routine to be interrupt driven. So you could run a program and when it has finished sprites can still be moving around. However the drawback is that only two sprites can be used, any more causes the screen to jump.

This command is turned off by the following commands:

FAST,SLOW,LPRINT,LLIST,COPY,LOAD, SAVE,DATA (new command) or when entering a program line.

Data takes the form:

RAND USR DATA

PRINT number of sprites

The data for the sprites is stored in a Rem statement after the machine code and 16 bytes is required for each sprite and two 'Newline' characters at the start to blank out the data. So to do this you use this command which produces enough bytes for the number of sprites in the Print statement.

REPORT CODES

T: no line after command which requires PRINT statement

W: flagS not correct length

U: charS not correct length

C: data missing in PRINT statement

One other thing is that if an 'over' sprite passes over another sprite it may leave part or all of that sprite behind but usually when it runs over anything it will not do this, but some very good 3-D effects can now be easily created.

Any commands which require a Print statement after them will change this Print to a Rem so if you edit the line with a Rem then this Rem must be converted back to a Print.

You can now test the program by entering some commands for yourself or type in the demonstration program. This program begins with four sprites bouncing around, now hit a key and they will wrap-round. Hit a key again and a sprite begins moving randomly, now every time a key is hit another sprite is added, the number of sprites on the screen is shown at the top left-hand corner of the screen. If the 0 key is pressed then the program ends but leaves two sprites moving around.

If a crash does occur reload the saved program and type in listing 4 and run it checking the output with listing 1.

If you have keyboardits and don't feel up to keying in this program then I will send you a cassette with SP.Basic and the demonstration program for £3.Malachy Devlin 50 Ruskey Road, Cookstown, Co. Tyrone, BT80 0AH.

Listing 3.

```
 99 REM HEX LOADER
100 PRINT "START ADDRESS"
110 INPUT S
120 PRINT "FINISH ADDRESS"
130 INPUT F
140 FOR N=S TO F STEP 8
150 LET T=0
160 PRINT N;" - ";
170 INPUT A$
180 PRINT A$;" = ";
190 INPUT TOT
200 PRINT TOT
210 LET Z=0
220 FOR K=1 TO LEN A$ STEP 2
230 LET C=(CODE A$(K)-28)*16+CO
DE A$(K+1)-28
240 LET T=T+C
250 POKE N+Z,C
260 LET Z=Z+1
270 NEXT K
280 IF TOT=T THEN GO TO 310
290 PRINT "ERROR - PLEASE INPUT
AGAIN"
300 GO TO 150
310 NEXT N
```

Does transcendental meditation produce the effects that are claimed for it? The HULK, a program for Bayesian analysis on the BBC microcomputer, can't give you a definitive answer to that question, but it can, as the name implies, Help Uncover Latent Knowledge.

The HULK is a set of three programs, one editor, and three demonstration files supplied on tape. The programs in the suite can be used for many different applications. If you can measure a number of things about a series of objects then the HULK can be used to classify the objects and make predictions about a related group of objects.

Transcendental meditation is described as a state of silent awareness devoid of any thought process. Large claims have been made for the techniques of transcendental meditation in terms of a reduction of stress, improvement in psychological and physical agility tests, and changes in the subject's electro-cardiogram.

Papers have been published in very respectable journals such as *Scientific American* (vol. 226, 1972, pp 84-90) and the *Lancet* (no.7651, 1970, p833) describing various aspects of the physiological changes that are said to occur during transcendental meditation.

Table 1.

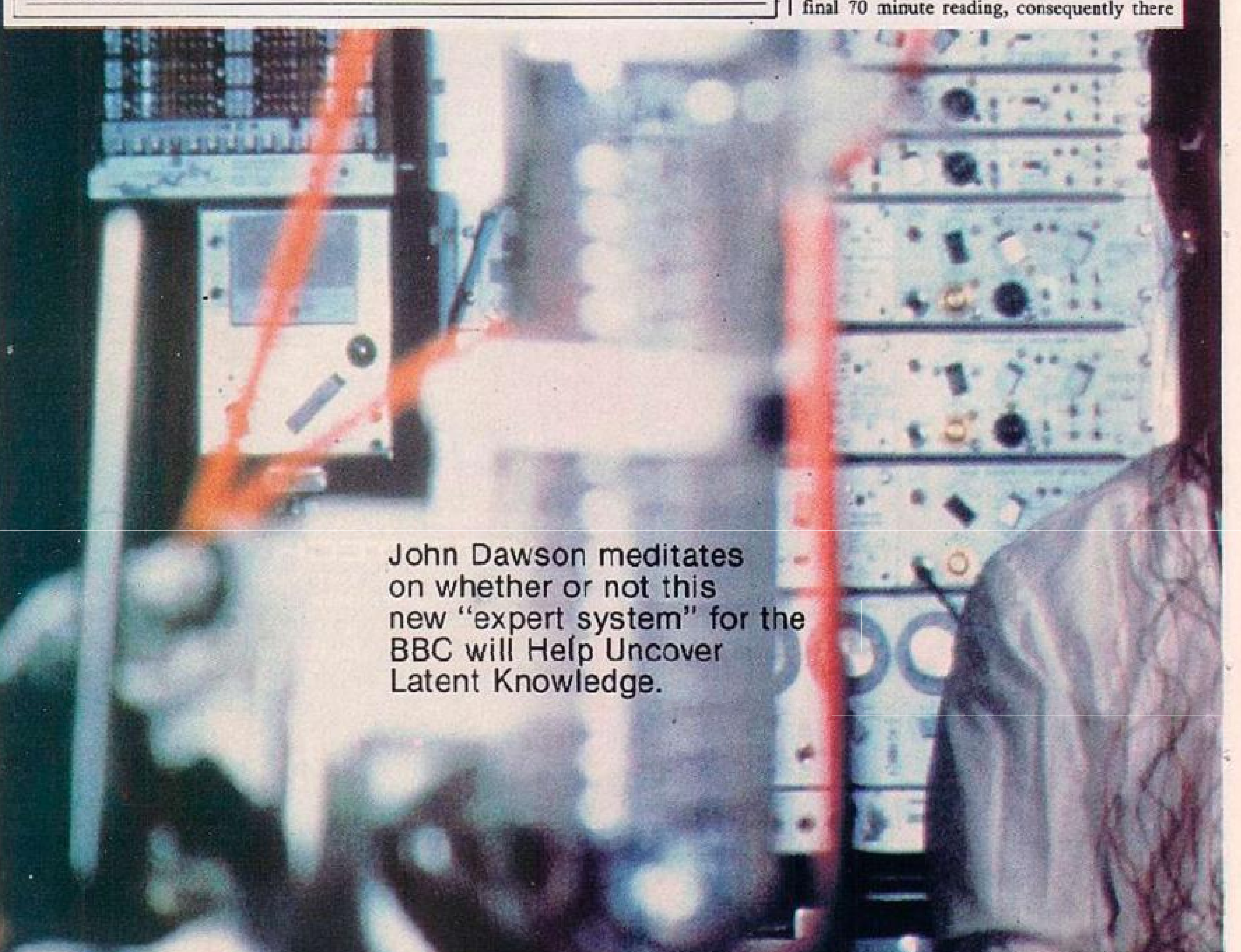
	Mean Blood Pressure						
	Pre.		Meditation			Post.	
Minutes	10	20	30	40	50	60	70
Subject							
13	70.0	67.5	62.5	62.5	65.0	67.5	65.0
2	78.0	78.0	73.0	75.5	78.0	79.5	80.0
21	76.0	74.0	71.5	76.0	76.0	77.0	79.0
6	90.0	90.0	87.5	90.0	91.0	91.0	87.5
14	70.0	72.5	72.5	72.5	67.5	67.5	70.0
Mean	76.8	76.4	73.4	75.3	75.5	76.5	76.3
S.E.	3.7	3.8	4.0	4.4	4.6	4.4	4.0
N	5	5	5	5	5	5	5

$p = < 0.500$

The data shown in table 1 relates to the blood pressure of a number of subjects before, during, and after transcendental meditation. It has been taken from a PhD thesis by Dr. R. K. Wallace from the University of California at Los Angeles. Data files for analysis by programs in the HULK suite are typed into the BBC micro like any Basic program but must be structured to a format described in the HULK User Guide.

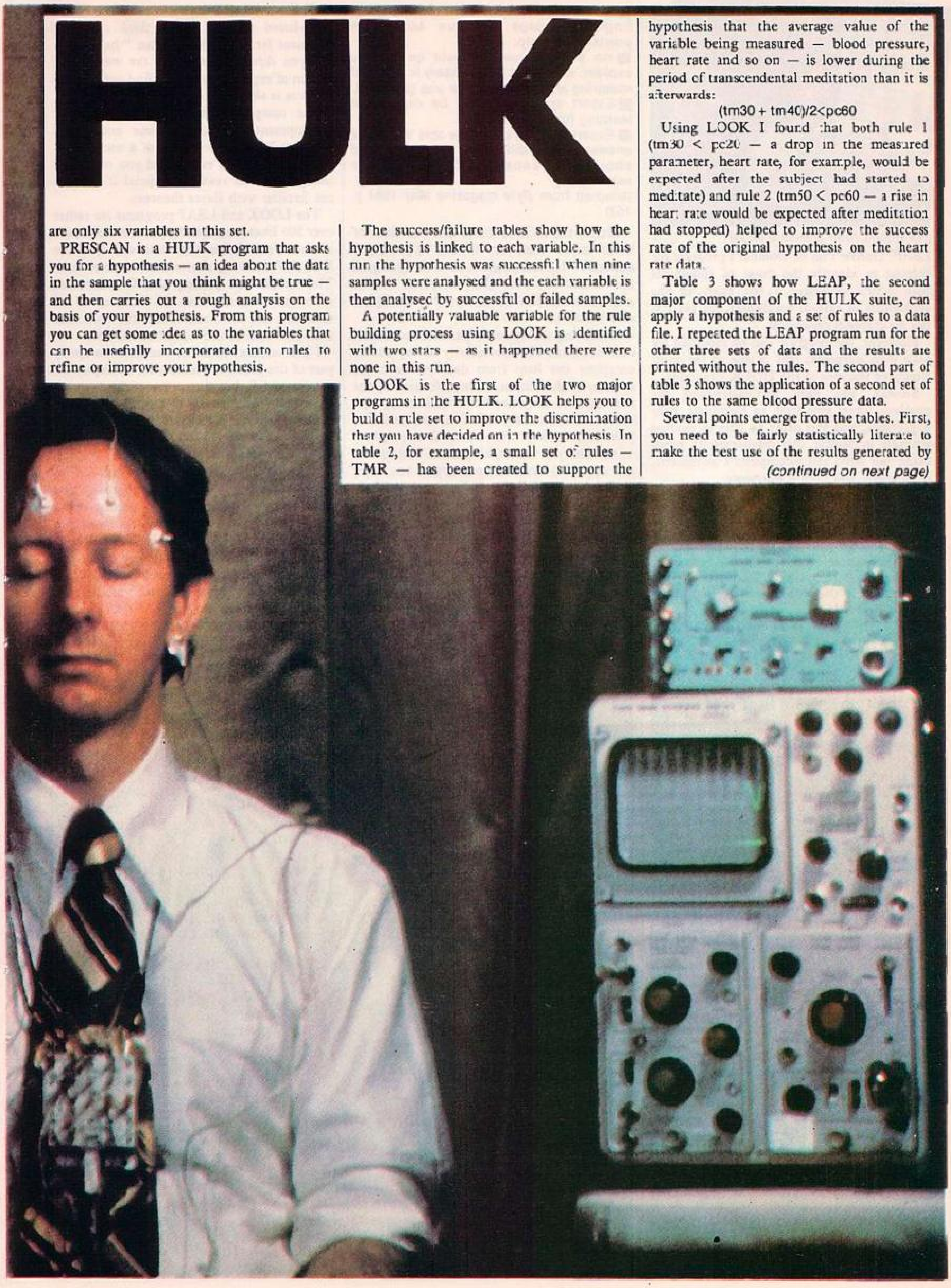
Unlike the data for the subject's heart rate the blood pressure data showed no significant decrease during the meditation phase. Indeed, it is difficult to draw any conclusions from the information in table 1. For the purposes of experimenting with the programs, however, I typed in four sets of data, one of which showed highly significant results — heart rate.

Three of the sets had seven variables, that is the elapsed time during the experiment and the number of samples, the subjects, varied in each set. One set of data stopped before the final 70 minute reading, consequently there



John Dawson meditates on whether or not this new "expert system" for the BBC will Help Uncover Latent Knowledge.

HULK



are only six variables in this set.

PRESCAN is a HULK program that asks you for a hypothesis — an idea about the data in the sample that you think might be true — and then carries out a rough analysis on the basis of your hypothesis. From this program you can get some idea as to the variables that can be usefully incorporated into rules to refine or improve your hypothesis.

The success/failure tables show how the hypothesis is linked to each variable. In this run the hypothesis was successful when nine samples were analysed and the each variable is then analysed by successful or failed samples.

A potentially valuable variable for the rule building process using LOOK is identified with two stars — as it happened there were none in this run.

LOOK is the first of the two major programs in the HULK. LOOK helps you to build a rule set to improve the discrimination that you have decided on in the hypothesis. In table 2, for example, a small set of rules — TMR — has been created to support the hypothesis that the average value of the variable being measured — blood pressure, heart rate and so on — is lower during the period of transcendental meditation than it is afterwards:

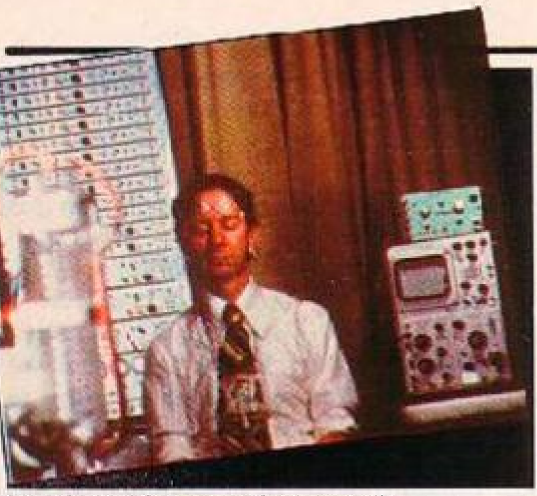
$$(tm30 + tm40)/2 < pc60$$

Using LOOK I found that both rule 1 ($tm30 < pc20$ — a drop in the measured parameter, heart rate, for example, would be expected after the subject had started to meditate) and rule 2 ($tm50 < pc60$ — a rise in heart rate would be expected after meditation had stopped) helped to improve the success rate of the original hypothesis on the heart rate data.

Table 3 shows how LEAP, the second major component of the HULK suite, can apply a hypothesis and a set of rules to a data file. I repeated the LEAP program run for the other three sets of data and the results are printed without the rules. The second part of table 3 shows the application of a second set of rules to the same blood pressure data.

Several points emerge from the tables. First, you need to be fairly statistically literate to make the best use of the results generated by

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LEAP. Unlike Tim de Dombal's program for helping to identify the cause of abdominal pain which produces a bar chart of the probability of various conditions, the HULK has no graphics capability.

However, the program can be modified for your own purposes; this is one of the most attractive features of the HULK programs.

Second, you need to understand the problem when you start to formulate your hypothesis, and you must be able to express yourself in logical and mathematical terms using the BBC microcomputer's arithmetic, comparison and logical operators.

"Proper" expert systems are said to have a number of features in common. Among them are:

■ An expert system should be able to acquire greater competency as rules are added to the system. Conversely, the absence of a rule should leave a gap in the system's capability.

■ An expert system should have an English-language dialogue and some provision for help.

■ An expert system should be able to explain: why a fact is necessary in a line of reasoning and how an answer was generated.

■ Expert systems should be capable of learning from experience.

■ Expert systems should be able to provide answers in conditions of uncertainty and should be capable of probabilistic reasoning.

(adapted from *Byte* magazine May 1984 p. 152)

Clearly the HULK scores more on some of these items than on others. The user's dialogue with the program is entirely logical and statistical with the exception of the starred ratings for "correctness" or usefulness of a variable.

Improving the system's performance is not automatic and depends heavily on the user to complete the loop from data put into the system, to the output, to modification of the next rule set and selection of data to type in.

Nevertheless, the HULK is well suited to providing answers where there is uncertainty in the data you are working with. The system can acquire greater competency as you work to refine the rules that you run over the data and I have no doubt that it can give you a greater insight into the relationships within a set of data. As the scrupulously honest User Guide says 'All you need is a data set, (and) some curiosity . . . Think of it as a research assistant.'

Brainstorm Computer Solutions say that the HULK is intended as a introduction to knowledge-based systems, and I think it is fair comment for them to claim that "the HULK lets you dip your toes into the warm blue lagoon of expert systems and find out what all the fuss is about."

The company proposes to carry on the development of the programs and wants feedback from users by way of a user group. Until the group is established you may need some additional reading material if you are not familiar with Bayes theorem.

The LOOK and LEAP programs are rather over 500 lines long and the point is well made in the User Guide that you will find the HULK frustrating to use from cassette tape. The sample coal mining data files supplied with the program have 64 samples of 30 variables and you must reload the data each time you wish to use LEAP or LOOK.

I am not sure whether that is a necessary part of the process, because, for example, the data is modified in the course of the analysis, or whether the program can be altered to allow you to run a different rule set over the same data without having to reload it.

All the programs are written in straightforward Basic and can be copied from tape to disc without any trouble. Any company that gives you a telephone number to ring and a program that you can build on for your own purposes must be good. The HULK will keep you absorbed for hours and may make you look at the world in a new, probabilistic, light.

And does transcendental meditation produce the effects claimed for it? Ah well . . .

Table 2. PRESCAN printout.

```
HYPOTHESIS: (tm30+tm40)/2<pc60
Variable 1      pc10
            SUCCESS 9   FAILURE 2
average:    70.89       77.00
std. dev.:  7.08        7.07
difference-score = 1.11
Variable 2      pc20
            SUCCESS 9   FAILURE 2
average:    70.22       76.50
std. dev.:  6.83        7.73
difference-score = 1.05

Variable 3      tm30
            SUCCESS 9   FAILURE 2
average:    66.78       76.00
std. dev.:  7.09        8.49
difference-score = 1.41

Variable 4      tm40
            SUCCESS 9   FAILURE 2
average:    65.00       73.00
std. dev.:  5.05        8.49
difference-score = 1.28

Variable 5      tm50
            SUCCESS 9   FAILURE 2
average:    66.67       71.00
std. dev.:  6.98        12.73
difference-score = 0.47

Variable 6      pc60
            SUCCESS 9   FAILURE 2
average:    69.89       72.50
std. dev.:  6.39        6.36
difference-score = 0.52
Variable 7      pc70
            SUCCESS 9   FAILURE 2
average:    68.89       77.50
std. dev.:  6.25        14.85
difference-score = 0.80
Data from: HR
```

Table 3. LEAP printout using first rule set

```
HYPOTHESIS IS:
        (tm30+tm40)/2 < pc60
Rule 1:  tm30 < pc20
Likelihood ratios:
        1.43        0.70
        0.77        1.30
Rule 2:  tm50 < pc60
Likelihood ratios:
        3.33        0.30
        0.59        1.70
SAMPLE              Prob. Success
 1 *S01             0.99   1
 2 *S21             0.99   1
 3 *S06             0.99   1
 4 *S13             0.99   1
 5  S10             0.99   0
 6 *S20             0.99   1
 7 *S23             0.97   1
 8 *S02             0.97   1
 9 *S22             0.97   1
10 *S24             0.75   1
11 *S05             0.47   0
Data from: HR
Rules used: TMR
Success rate = 90.9090909%
SAMPLE              Prob. Success
 1 *S21             0.99   1
 2 *S02             0.99   1
 3 *S13             0.99   1
 4 *S06             0.75   1
 5 *S14             0.47   0
Date from: BP
Rules used: TMR
Success rate = 100%
SAMPLE              Prob. Success
 1  S23             0.99   0
 2 *S13             0.99   1
 3 *S14             0.99   1
 4 *S07             0.99   1
 5 *S09             0.99   1
 6 *S20             0.97   1
 7 *S22             0.97   1
 8  S01             0.75   0
 9  SO6             0.75   0
10 *S02             0.75   1
Data from: PO2
Rules used: TMR
Success rate = 70%
SAMPLE              Prob. Success
 1 *S03             0.97   1
 2 *S05             0.97   1
 3 *S01             0.97   1
 4  S02             0.97   0
 5 *S06             0.75   1
 6 *S04             0.47   0
Data from: RQ
Rules used: TMR
Success rate = 83.3333333%

LEAP printout using second rule set
HYPOTHESIS IS:
        (pc10+pc20)/2 > pc60
Rule 1:  tm30 < pc20
Likelihood ratios:
        3.57        0.28
        0.71        1.40
Rule 2:  (tm30+tm40+tm50)/3 < pc60
Likelihood ratios:
        0.10        9.80
        3.10        0.32
SAMPLE              Prob. Success
 1 *S14             0.77   1
 2 *S06             0.03   0
 3 *S21             0.03   0
 4 *S02             0.03   0
 5 *S13             0.03   1
Data from: BP
Rules used: TMR3
Success rate = 80%
```

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TEXT



COMPRESSION

Alan Tobias goes in for a little letter crunching on the Spectrum.

TEXT COMPRESSION METHODS have been in use on computer systems for a number of years and a variety of techniques are available. A recent article in *Your Computer* (L.F. Boulton, Vol.4, No 3) demonstrated such a technique for the ZX-81 where the unused character codes were used to represent the more commonly found character pairs. This type of tokenisation has been used widely with the unused ASCII codes 128 to 255 being taken to represent groups of letters, words or even frequently occurring phrases. However, a limitation of this method is due to the fact that only 128, or at most 255, token values are possible, ie. the text may be only partially tokenised. I will describe a simple text compression technique which overcomes this limitation and enables any piece of text to be totally tokenised.

The principle of tokenising text appears very attractive since it is easy to see that commonly occurring words or phrases can be replaced by tokens of far fewer bytes than the original text. Single byte tokens, having values in the range 0 to 255, impose severe limitations as we have already noted. Two byte tokens, with values in the range 0 to 65535, are obviously excessive. However, when we consider the number of different words likely to be found in an adventure text database, or even in every day usage, we find that this number is only a few thousand. Therefore, if we use two bytes per token and limit the number of items in the dictionary to 2048, which is more than adequate for the majority of applications, then the token number may be stored in 11 bits only with the 5 remaining bits being used to convey additional information about the text. In developing this technique I decided to use these bits to describe details of the text punctuation and layout.

Before proceeding, we should note that one of the most commonly occurring characters in any passage of text is a space. Furthermore, we can see that, with the exception of words which terminate exactly at the end of full width lines (including any commas or periods), all words may be regarded as having a trailing space. Thus, if our decoding/expansion routine is able to apply this simple rule then there is no need to code spaces explicitly.

An obvious application of some of the unused token bits is to indicate the presence of commas or periods following any word. By using a separate bit for each of these it is possible to accommodate words which are followed by both.

When we construct the dictionary of different words which appear in the text, it is obviously desirable that any word occurring both at the start and in the middle of a sentence is stored in the dictionary once only. Therefore, it would be advantageous to use one of the token bits to indicate that a word should be output with a capital letter at its start. This requires that all words stored in the dictionary should have their first letters converted to lower case. Again it is possible for our decoding routine to apply some simple rules, namely that a word should be automatically output with a capital letter at the start of any text message or following a period. It will therefore be necessary to code the capital letter flag bit only when these are required in the middle of a sentence.

Another punctuation item which could usefully be coded in a token bit is the presence of a newline character following a word plus its trailing blank, period or comma. However, we can again minimise the text coding by having the decoding routine provide a newline character automatically if the next word to be output will not fit within the current line. Thus, it will be necessary only to code those newline characters which are specifically required at particular points in the text.

In setting up the two byte tokens I have taken care to minimise the number of bits which will be set for any word. This means

Table 1. Special input characters

Character	ASCII Code	Interpretation
@	64	Treat as a space within phrases
^	94	Insert newline character after word
—	95	End of input for current message

Listing 1. The hex loader.

```
  10 REM hex loader
  20 DEF FN h$(a)=CHR$ (INT (a/1
6)+48+7*(a>159))+CHR$ (a-16*INT
(a/16)+48+7*((a-16*INT (a/16))>9
))
  30 DEF FN h(h$)=CODE h$-48-7*(
CODE h$>57)
  40 INPUT "Start Address:";s
  50 INPUT "Finish Address:";f
  60 FOR n=s TO f STEP 8
  70 PRINT n;": ";
  80 LET tot=0
  90 INPUT a$
 100 IF a$="END" THEN STOP
 110 PRINT a$
 120 FOR b=0 TO 7
 130 LET z=FN h(a$)*16+FN h(a$(2
))
 140 LET tot=tot+z
 150 POKE (n+b),z
 160 LET a$=a$(4 TO )
 170 NEXT b
 180 PRINT " = ";
 190 INPUT t
 200  IF t<>tot THEN  PRINT "Dat
a input error": GO TO 70
 210 PRINT t
 220 NEXT n
 230 STOP
```

(continued on page 127)

COMCON

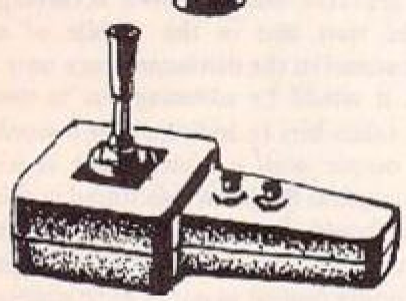


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(continued from page 125)

that for the large majority of words in a passage of text the token will contain the word's dictionary number only. For dictionary numbers less than 256 a single byte token would thus suffice in many cases. However, we need some means of telling the decoding routine whether it should expect a one- or two-byte token. This can be achieved by using the one remaining unused bit of the token which, through necessity, will be located in the first byte of the token together with the low order bits of the dictionary item number. This arrangement will permit single byte tokens for dictionary numbers less than 128 when the words require no punctuation flag bits.

The one remaining item we need to define is the means of terminating each string of tokens which represent a message. For this we require some unique byte value. If in the tokens we add 1 to the dictionary numbers, so that there is a maximum of 2047 dictionary entries numbered from 1 to 2047, we find that a zero value byte will provide a suitable message terminator. Thus, if we want to print out any text message then it is necessary only to locate the appropriate occurrence of a zero byte and begin printing at the token which follows it.

For the present it is assumed that the total number of different text messages within the data base will not exceed 256. The required message number for output may then be specified by a single byte. Applications having more than 256 different text messages may be accommodated by permitting a suitable number of message lists all based upon a single text dictionary.

In storing the text dictionary we need some means of marking the end of each entry. A suitable method of doing this appears in the Spectrum ROM and has been used here. It is done by setting bit 7 of the final character in each entry thus giving it an ASCII code of greater than 127. Any required dictionary entry is then found by locating the appropriate occurrence of a dictionary byte in which bit 7 has been set.

Earlier, we saw that it was not necessary to code trailing spaces explicitly. Therefore, if we want to define phrases which are to be tokenised then it is necessary to consider other

(continued on next page)

Listing 2.

```
31000: FE 00 C4 3E 79 3E 08 32 = 753
31008: D1 79 7E FE 00 C8 16 C0 = 945
31016: 5F 23 CB 43 28 02 56 23 = 563
31024: CB 1A CB 1B 1B E5 C5 CD = 1117
31032: 4A 79 C1 E1 18 E4 C5 47 = 1133
31040: 7E 23 FE 00 20 FA 10 F8 = 961
31048: C1 C9 C5 E1 CD B6 79 CD = 1529
31056: 97 79 3A DE 79 E2 57 AF = 1113
31064: CB 5A 28 02 3E E0 86 CB = 958
31072: BF FE 40 20 02 3E 20 CD = 842
31080: D6 79 AF CB 7E 23 28 EE = 1152
31088: CB 62 28 C7 3E 2E CD B6 = 875
31096: 79 3E C8 32 D6 79 3E 2C = 690
31104: CB 6A C4 D6 79 3A 88 5C = 1126
31112: FE C1 3E 20 C4 D6 79 3E = 942
31120: 0D CB 72 C4 D6 79 C9 E5 = 1291
31128: D5 C5 3A 88 5C 3D 3D CB = 1021
31136: 7E 23 28 FA CD 62 28 01 = 793
31144: 3D CB 6A 28 01 3D FE 20 = 758
31152: 38 28 3E 0D 18 23 7A E6 = 532
31160: C7 FE 00 C4 C7 79 7B FE = 1154
31168: 00 C8 43 3E 01 18 02 06 = 362
31176: 00 CB 7E 23 28 FB 10 F9 = 920
31184: 3D FE 00 20 F2 C9 E5 D5 = 1232
31192: C5 D7 C1 D1 E1 C9 01 CD = 1446
31200: 68 00 3E 02 CD 01 16 3A = 470
31208: B0 5C ED 4B 2F 7B 2A 31 = 841
31216: 7B C3 18 79 DD 21 01 5B = 809
31224: DD 7E 00 FE 5F CA 77 7A = 1139
31232: 1E 00 16 00 4A 21 3E 7B = 344
31240: DD 7E 00 DD 23 FE 5E 28 = 991
31248: 4C FE 20 28 34 FE 2E 20 = 786
31256: 04 CB E1 18 2C FE 2C 20 = 830
31264: 04 CB E9 18 24 77 7A FE = 995
31272: 00 20 15 7E FE 5B 30 10 = 580
31280: FE 41 38 0C C6 20 77 3A = 794
31288: DE 79 FE 00 20 02 CB D9 = 1051
31296: 23 14 1C 3A 00 5B BB 3C = 467
31304: BE 1C 3A 00 5B BB 3A 14 = 631
31312: DD 7E 00 FE 20 20 06 1C = 699
31320: DD 23 DD 7E 00 FE 5E 2C = 903
31328: 03 1C CB F1 7A 32 3E 7B = 831
31336: CD 81 7A 3A 00 5B BE 30 = 840
31344: 91 2A 35 7B AF 77 C5 2A = 900
31352: 35 7B AF 77 23 22 35 7B = 715
31360: C9 D3 E5 D5 E5 11 00 00 = 1110
31368: 21 37 7B 7E FE 00 20 06 = 629
31376: 23 7E FE 00 28 47 DD 2A = 789
31384: 2F 7B DD 2B 21 3E 7B 3A = 710
31392: 3D 7B 47 DD 23 DD 7E C0 = 858
31400: CB BF BE 23 20 18 7B FE = 1049
31408: 01 23 06 DD CB 00 7E 28 = 631
31416: 00 13 06 DD CB 00 7E 20 = 625
31424: 05 1D E0 D5 18 3A DD CB = 964
31432: 00 7E DD 23 28 F8 DD 2B = 934
31440: 13 21 37 7B 7E EB 20 C4 = 771
31448: 23 7E BA 20 BF 2A 37 7B = 790
31456: E5 23 22 37 7B 2A 33 7B = 692
31464: DD 21 3E 7B 2A 3D 7D 47 = 782
31472: DD 7E C0 DD 23 77 23 10 = 773
31480: F7 2B CB FE 23 22 33 7B = 990
31488: AF CB 41 28 01 3C 32 DE = 848
31496: 79 D1 2A 35 7B 13 7A E6 = 919
31504: C7 B1 57 AF CD 13 CB 12 = 889
31512: 7A FE 00 28 02 CB C3 73 = 931
31520: 23 CB 43 28 02 77 23 22 = 535
31528: 35 7B E1 D1 DD E1 C9 00 = 1257
```

Listing 3.

```
 10 REM *TEXT COMPRESSION SYSTEM*
 20 REM  A. Tobias: June 1984
 30 REM ** Main Driving Routine
 40 BORDER 1: PAPER 1: INK 7
 50 CLS : PRINT "     TEXT COMPR
ESSION SYSTEM": PRINT "
                  ": PRINT : PRI
NT
 60 PRINT TAB 9; INK 0; PAPER 5
;"* A.Tobias *": PRINT
 70 PRINT TAB 13; PAPER 7; INK
0;"MENU": PRINT : PRINT
 80 PRINT "  1.  Reset Message
Pointers     2.  Input Text vi
a Keyboard     3.  List Stored T
ext            4.  List Current
Dictionary     5.  Compression S
tatistics      6.  Save Dictiona
ry/Text        7.  Load Dictiona
ry/Text"
 90 INPUT "Required Option ?";o
pt
 100 IF opt<1 OR opt>7 THEN GO T
O 90
 110 PRINT AT (opt+8),3; FLASH 1
;opt
 120 PAUSE 100
 130 GO SUB (opt*1000)
 140 GO TO 40
 150 CLEAR 30999
 160 LOAD ""CODE
 170 GO TO 10
 700 LET x=nd: GO SUB 940
 710 POKE 31543,1: POKE 31544,h
 720 LET x=nm: GO SUB 940
 730 POKE 31545,1: POKE 31546,h
 740 LET x=ch: GO SUB 940
 750 POKE 31547,1: POKE 31548,h
 760 RETURN
 800 LET nd=PEEK 31543+PEEK 3154
4*256
 810 LET nm=PEEK 31545+PEEK 3154
6*256
 820 LET ch=PEEK 31547+PEEK 3154
8*256
 830 RETURN
 900 PAUSE 30
 910 PRINT £1;AT 1,0;"Press any
key to continue."
 920 IF CODE INKEY$=0 THEN GO TO
920
 930 RETURN
 940 LET h=INT (x/256)
 950 LET l=x-h*256
 960 RETURN
 1000 REM ** Reset Pointers **
 1010 BORDER 1: PAPER 1: INK 7
 1020 CLS
 1030 PRINT "Reset Dictionary Sto
rage ?": PRINT
 1040 INPUT r$
 1050 IF r$="n" OR r$="N" THEN GO
 TO 1160
 1060 IF r$<>"y" AND r$<>"Y" THEN
 GO TO 1040
 1070 PRINT "Dictionary Base Addr
ess ?        (0 for no change)"
 1080 INPUT x: IF x=0 THEN GO TO
1100
 1090 GO SUB 940: POKE 31535,1: P
OKE 31536,h
 1100 POKE 31543,0: POKE 31544,0
 1110 POKE 31539,PEEK 31535
 1120 POKE 31540,PEEK 31536
 1130 POKE 31547,0: POKE 31548,0
 1140 PRINT "Dictionary has been
reset.": PRINT
 1150 GO TO 1200
 1160 PRINT "Reset Text Storage ?
": PRINT
 1170 INPUT r$
 1180 IF r$="n" OR r$="N" THEN GO
 TO 1270
 1190 IF r$<>"y" AND r$<>"Y" THEN
 GO TO 1170
 1200 POKE 31545,0: POKE 31546,0
 1210 PRINT "Text Base Address ?
                (0 for no change)"
 1220 INPUT x: IF x=0 THEN GO TO
1240
 1230 GO SUB 940: POKE 31537,1: P
OKE 31538,h
 1240 POKE 31541,PEEK 31537
 1250 POKE 31542,PEEK 31538
 1260 POKE 31547,0: POKE 31548,0
 1270 PRINT "Text Storage has bee
n reset."
 1280 GO SUB 900
 1290 RETURN
 2000 REM ** Input Text **
 2010 BORDER 5: PAPER 5: INK 0
 2020 GO SUB 800
 2030 IF nd<2000 THEN GO TO 2070
 2040 CLS : PRINT FLASH 1;"WARNIN
G"
 2050 PRINT "No. of Dictionary It
ems > 2000"
 2060 GO SUB 900
 2070 CLS : PRINT "Message No. ";n
m
 2080 POKE 31198,1
 2090 INPUT a$
 2100 LET a=LEN a$
 2110 IF a=0 THEN GO TO 2090
 2120 IF a<=255 THEN GO TO 2150
 2130 PRINT AT 20,0;"Error - stri
ng > 255 Characters Please retyp
e input"
 2140 GO TO 2090
 2150 POKE 23296,(a-1)
 2160 FOR i=1 TO a
 2170 POKE (23296+i),CODE a$(i)
 2180 NEXT i
 2190 RANDOMIZE USR 31220
 2200 IF a$(1)="_" THEN GO TO 227
0
 2210 PRINT AT 1,0;
 2220 LET c=PEEK 31198
 2230 POKE 23728,nm: RANDOMIZE US
R 31207
 2240 POKE 31198,c
 2250 LET ch=ch+a
```

(listing continued on next page)

(continued from previous page)

ways of representing spaces within these phrases. A simple solution is to represent them by some other character, preferably one which is unlikely to be found elsewhere in the text. The system described here has been designed to interpret the character '@' (ASCII 64) as a 'phrase space'. When found in a phrase this character is stored explicitly in the dictionary entry whereas during output it is replaced by a true space.

Using the hex loader shown in listing 1, you can load the Z-80 machine-code routines which will both compress and expand text according to the system described above. Listing 2 gives a hexadecimal dump of the Z-80 machine-code routines. The decoding routine occupies 199 bytes beginning at location 31000 and the compression routine occupies 315 bytes starting at location 31220. The code beginning at location 31199 merely sets up the registers for the expansion routine as used by this overall program.

The first location of the printer buffer (23296) holds the total number of characters in an input line or lines of text while the remainder of the buffer — 23297 to 23551 — is used to store the input text.

Listing 3 gives the Basic program which will drive the text compression routines described above. It is menu driven and is simple to use. Option 1 enables you to reset the base addresses for both the dictionary and the tokenised messages. It is *essential* that you select this option prior to initial text input.

During operation of the program the dictionary of words and phrases is built up as the text input is scanned. This method of operation is sensible since, for large text databases, it is unlikely that both the original and compressed text may be stored simultaneously. In order to take full advantage of the use of single byte tokens it is advisable to enter some dummy text messages initially which contain the words you believe to occur most frequently in your text. When you have done this, reset the message storage but retain the dictionary.

Because the program given here has been devised to compress text as it is input from the keyboard, it enables you to lay out the text as required. During input you may type in up to eight lines of text at once — maximum of 255 characters — and each section of input does not have to finish at the end of a sentence. It is only necessary to ensure that you leave a space between each word.

When you have completed the input for a message type the character "—" (ASCII 95) as the first character of a new single item of input. As was noted above, newline characters are automatically provided if the next word to be printed will not fit into the current line. Additional newline characters can be inserted into the text by including a "^" character (ASCII 94) at the appropriate place.

With the exception of the characters shown in table 1, for which special interpretation applies, all ASCII characters with codes in the range 32 to 127 will be treated as normal text characters.

Note that if you want to save some compressed text for subsequent extension then it is essential that this is done by the program so that all pointers are preserved. These pointers are required only for the compression system's book-keeping and are not needed by any program which will use the compressed test. Similarly, the compression routine, stored in locations 31220 to 31534, may be omitted from the target program. You will, however, require the heart of the expansion routine — stored in locations 31000 to 31198, or suitably relocated as required. On entry to the start of this routine, register 'a' should contain the required message number and register pairs 'hl' and 'bc' should point to the start addresses of the text tokens and dictionary respectively. Since these are saved as 'code' and are position independent they may be loaded into any region of memory for your target program. ■

Figure 1. Text Example and corresponding tokens.

Message: You are in a dark, damp cellar with a narrow passageway leading south.

Word/Phrase	Token Value(s)
You are in	2
a	4
dark,	7, 64
damp	8
cellar	10
with	12
a	4
narrow	14
passageway	16
leading	18
south.	21, 32, 0

No. of token bytes in compressed message = 14

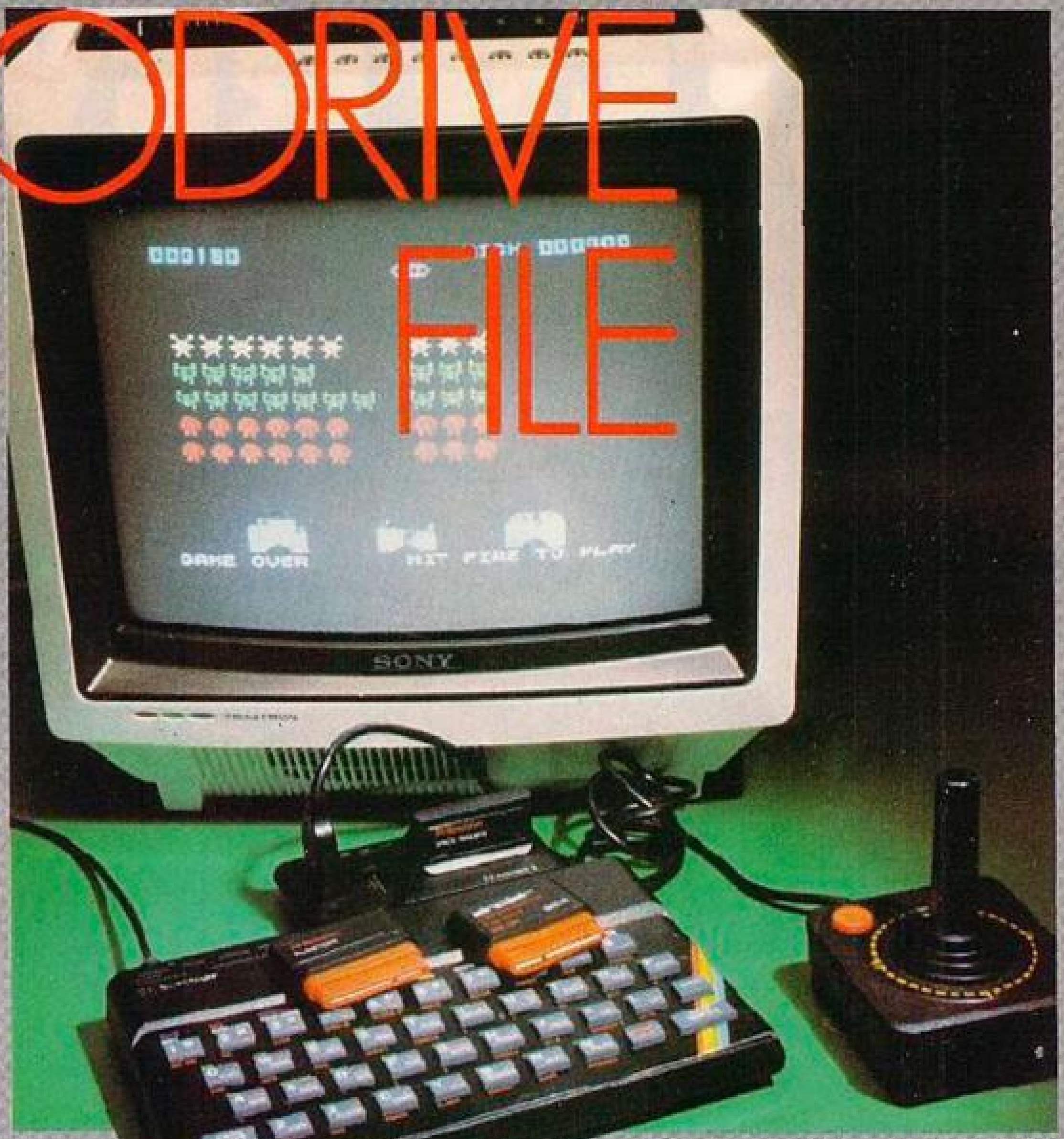
(listing continued from previous page)

```
2260 GO TO 2090
2270 LET nm=nm+1
2280 INPUT "Any more text ?";r$
2290 IF r$="y" OR r$="Y" THEN GO
 TO 2070
2300 LET nd=PEEK 31543+PEEK 3154
4*256: GO SUB 700
2310 IF nd<2000 THEN GO TO 2330
2320 CLS : PRINT FLASH 1;"WARNIN
G": PRINT "Dictionary Almost Ful
l !"
2330 GO SUB 900
2340 RETURN
3000 REM ** Print Stored Message
s **
3010 BORDER 4: PAPER 4: INK 0
3020 GO SUB 800
3030 IF nm=0 THEN RETURN
3040 FOR i=0 TO nm-1
3050 POKE 23728,i
3060 RANDOMIZE USR 31199
3070 PRINT AT 21,0;"Message No."
;i
3080 GO SUB 900
3090 NEXT i
3100 RETURN
4000 REM ** Print Dictionary **
4010 BORDER 5: PAPER 5: INK 1
4020 GO SUB 800: IF nd=0 THEN RE
TURN
4030 LET wds=PEEK 31535+PEEK 315
36*256: CLS
4040 FOR i=1 TO nd STEP 20
4050 CLS : PRINT PAPER 1; INK 7;
"DICTIONARY ITEM";TAB 20;"ENTRY
NO.": PRINT
4060 FOR j=i TO i+19
4070 LET c=PEEK wds: LET wds=wds
+1
4080 LET d=c: IF c>128 THEN LET
c=c-128
4090 PRINT CHR$ c;
4100 IF d<128 THEN GO TO 4070
4110 PRINT TAB 20;j
4120 IF j=nd THEN GO TO 4140
4130 NEXT j
4140 GO SUB 900
4150 NEXT i
4160 RETURN
5000 REM ** Compression Statisti
cs **
5010 BORDER 6: PAPER 6: INK 1: C
LS
5020 GO SUB 800
5030 PRINT "COMPRESSION STATISTI
CS": PRINT "--------------------
--": PRINT : PRINT
5040 PRINT "Uncompressed Text";T
AB 20;ch;TAB 27;"bytes": PRINT :
 PRINT
5050 LET cl=PEEK 31539+PEEK 3154
0*256-(PEEK 31535+PEEK 31536*256
)
5060 PRINT "Dictionary Items";TA
B 20;nd: PRINT
5070 PRINT "Dictionary Size";TAB
 20;cl;TAB 27;"bytes": PRINT
5080 LET ml=PEEK 31541+PEEK 3154
2*256-(PEEK 31537+PEEK 31538*256
)
5090 PRINT "Compressed Text";TAB
 20;ml;TAB 27;"bytes": PRINT : P
RINT
5100 PRINT "Dictionary + Text";T
AB 20;(dl+ml);TAB 27;"bytes": PR
INT : PRINT
5110 LET x=INT (10000*(1-(dl+ml)
/ch))/100
5120 PRINT "Compression Factor";
TAB VAL "20"; FLASH VAL "1";x;"
%"
5130 GO SUB 900
5140 RETURN
6000 REM ** Save to Tape **
6010 BORDER 0: PAPER 0: INK 7
6020 GO SUB 700
6030 CLS : PRINT "Load tape and
prepare to record."
6040 PRINT : PRINT "Saving Point
ers."
6050 SAVE "Pointers"CODE 31535,1
5
6060 LET x=PEEK 31535+PEEK 31536
*256
6070 LET l=PEEK 31539+PEEK 31540
*256-x
6080 PRINT "Done.": PRINT : PRIN
T "Saving Dictionary."
6090 SAVE "Dictionary"CODE x,l
6100 LET x=PEEK 31537+PEEK 31538
*256
6110 LET l=PEEK 31541+PEEK 31542
*256-x
6120 PRINT "Done.": PRINT : PRIN
T "Saving Compressed Text."
6130 SAVE "Text"CODE x,l
6140 PRINT "Done."
6150 GO SUB 940
6160 GO SUB 900
6170 RETURN
7000 REM ** Read from Tape **
7010 BORDER 0: PAPER 0: INK 7
7020 CLS : PRINT "Load tape in r
ecorder and start."
7030 PRINT : PRINT "Loading Poin
ters"
7040 LOAD ""CODE 31535
7050 PRINT : PRINT "Loading Dict
ionary"
7060 LET x=PEEK 31535+PEEK 31536
*256
7070 LOAD ""CODE x
7080 PRINT : PRINT "Loading Comp
ressed Text"
7090 LET x=PEEK 31537+PEEK 31538
*256
7100 LOAD ""CODE x
7110 GO SUB 940
7120 GO SUB 900
7130 RETURN
9500 SAVE "Comptext" LINE 150
9510 SAVE "Code"CODE 31000,550
```



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MICRODRIVE FILE



Kathleen Peel with an appraisal of Microdrives after eight months' use.

IT IS EIGHT MONTHS since a Microdrive first appeared on my desk so it is about time I presented a brief long-term appraisal of the reliability of not only the drives, but also the Microdrive operating system.

During the eight month period, nearly all the reviews I have written have used a Microdrive-based word processor. Also much software development has taken place for the Spectrum and the now extinct Timex 2068.

This has resulted in almost continuous use for cartridges employed in software development over a period of weeks and a periodic exercise for the cartridges used for the reviews.

Combined with this almost continuous use of the Spectrum Microdrives can be coupled preliminary thoughts on the QL drives and the QL's operating system, which have received a great deal of my attention lately.

Although the Spectrum Microdrives have worked without losing any files — and not all disc drives can have that said about them — that does not mean they are without minor niggling faults.

The restraints placed on program transfer restrict the ability to produce a simple Basic back up program to transfer all the programs and data on the cartridge to cassette tape and back again. The cost of cartridges makes it very expensive to create a library as they only have a fraction of the storage capacity of a cassette and there is also no convenient way of storing cartridges.

One of the early problems was in finding somewhere safe to store the very small cartridges. they are very much smaller than the new 3-inch Japanese micro-floppies.

The plastic wallet now supplied free with cartridges bought in packs of four is a great help in overcoming the problem of misplacing a cartridge, or more likely its cover. It would have been perfect if the wallet could have been made to fit the cassette racks.

Another problem that arises as a result of the small size of the cartridges is indexing contents. Cassettes cases are provided with an inlay card for this very purpose, a quick glance along a cassette rack will normally find a tape — with the cartridges this is not possible.

A solution for two-drive setups is for drive 1 to contain the working files and drive 2 the utilities and system index. This works well provided none of the utilities are very large.

Although the Microdrives perform adequately for speed, on cartridges with a lot of free space I tend to double-save each program as it does make the drives load even quicker.

There was a stage when I started writing utilities to handle the rather long syntax command entries but, after a while, these became restrictive as they used up space which could be better used elsewhere.

The QL drives have been extremely erratic and so far have frequently refused to load programs that have just been saved. As this problem does not afflict all programs on the cartridge, it can be assumed that the problem lies with the QL's operating system — QLOSS.

My impression is that the QL seems to lose track of where it has just loaded or saved a file, possibly due to changes to the stack pointer brought about by breaks. As none of the programs contain machine-code or memory Pokes, they are purely Basic, this is very disappointing.

There appears to be no vertical restraint for the cartridges at the front edge. This can lead to the cartridge rocking between the top and bottom surfaces of the Microdrive causing a rhythmic banging of the cartridge case, a problem that also appears in the Spectrum drives.

If you already have Spectrum Microdrives, they can be used with the QL in a read only mode. Format and save are not possible — I'm not sure why saving is not possible at the moment. Just remember to use QL formatted and written cartridges. The Psion cartridges make reference to a specific Microdrive and may not work.

The Interface 1 is extremely good — the only minor problem is the lack of a Tab function, but that can be overcome if necessary.

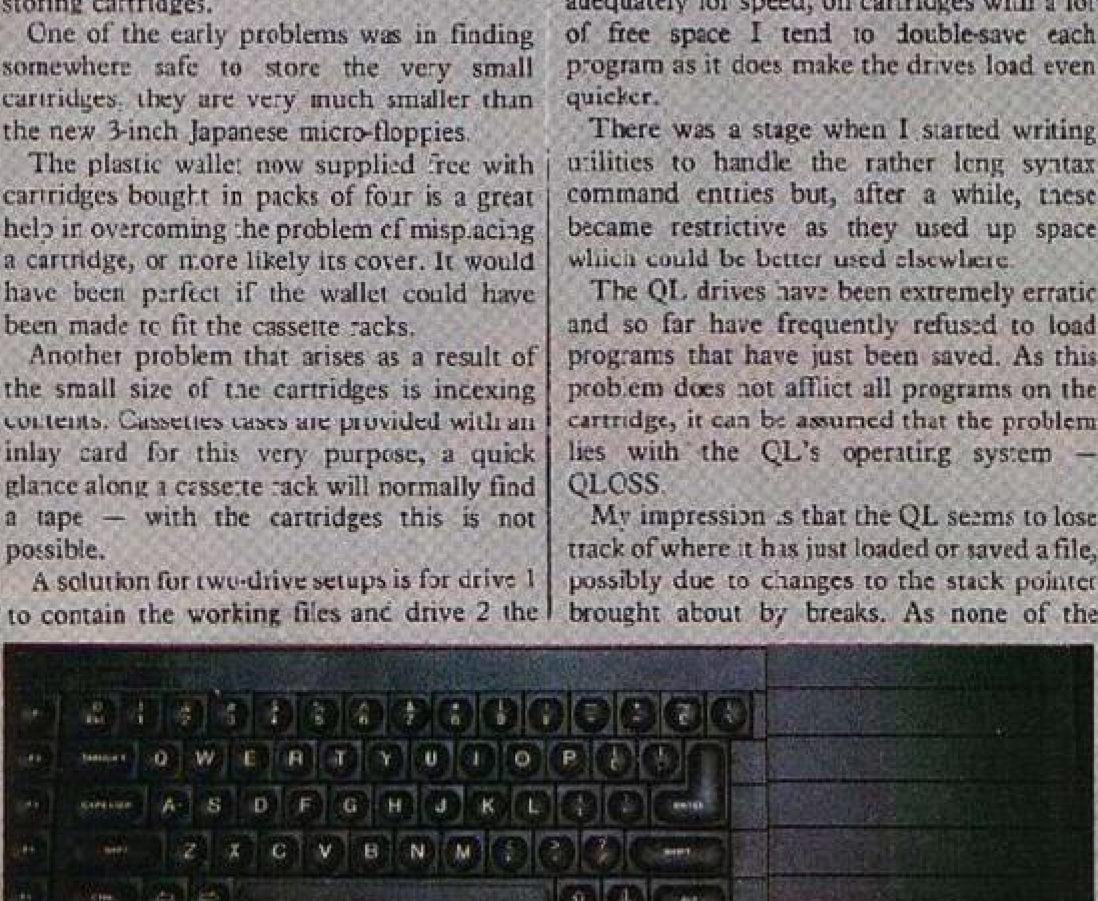
The RS-232 capability has allowed connection to virtually everything that I have tried and the Spectrum to Spectrum networking is also very good and extremely fast.

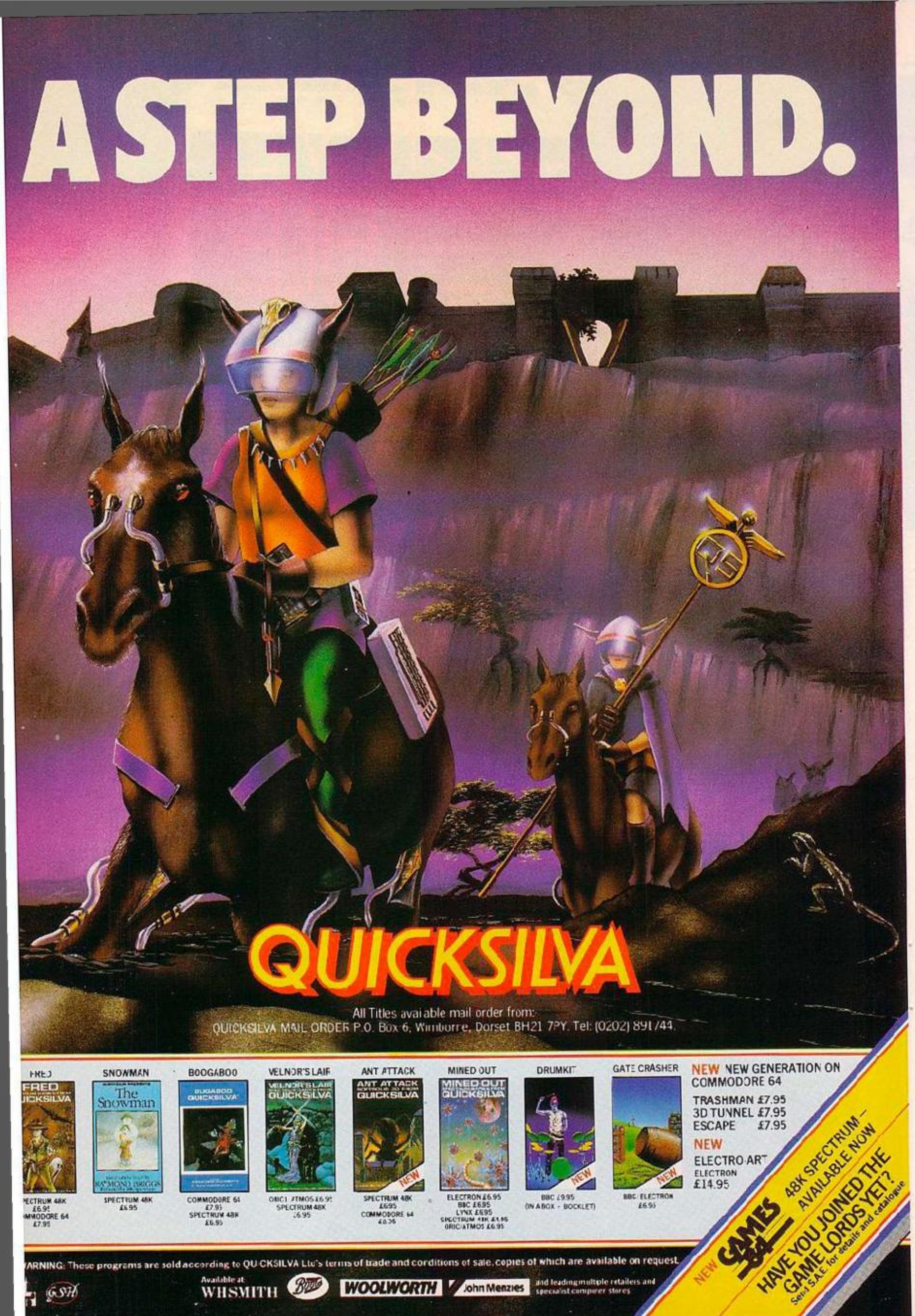
Strange, then, that the QL should not be fully able to link with the Spectrum over the network. The Spectrum passes tokenised keywords which the QL cannot read. This may well be compounded by adding two incompatible sets of timings.

Overall, the performance of the Spectrum Microdrives is highly satisfactory and complaints revolve around minor details of logistics.

The drives have virtually the same

(continued on page 133)





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(continued from page 131)
performance as the disc drives I have used recently except for the lack of random access to Spectrum files

I have a feeling that the high cost of cartridges is being used to restrict demand for the cartridges while production builds up.

The peformance of the QL Microdrives is far less satisfactory. There appears to be a major design problem in the software which allows a user to create non-loading files from Basic programs which do not contain machine-code or system Pokes. ■

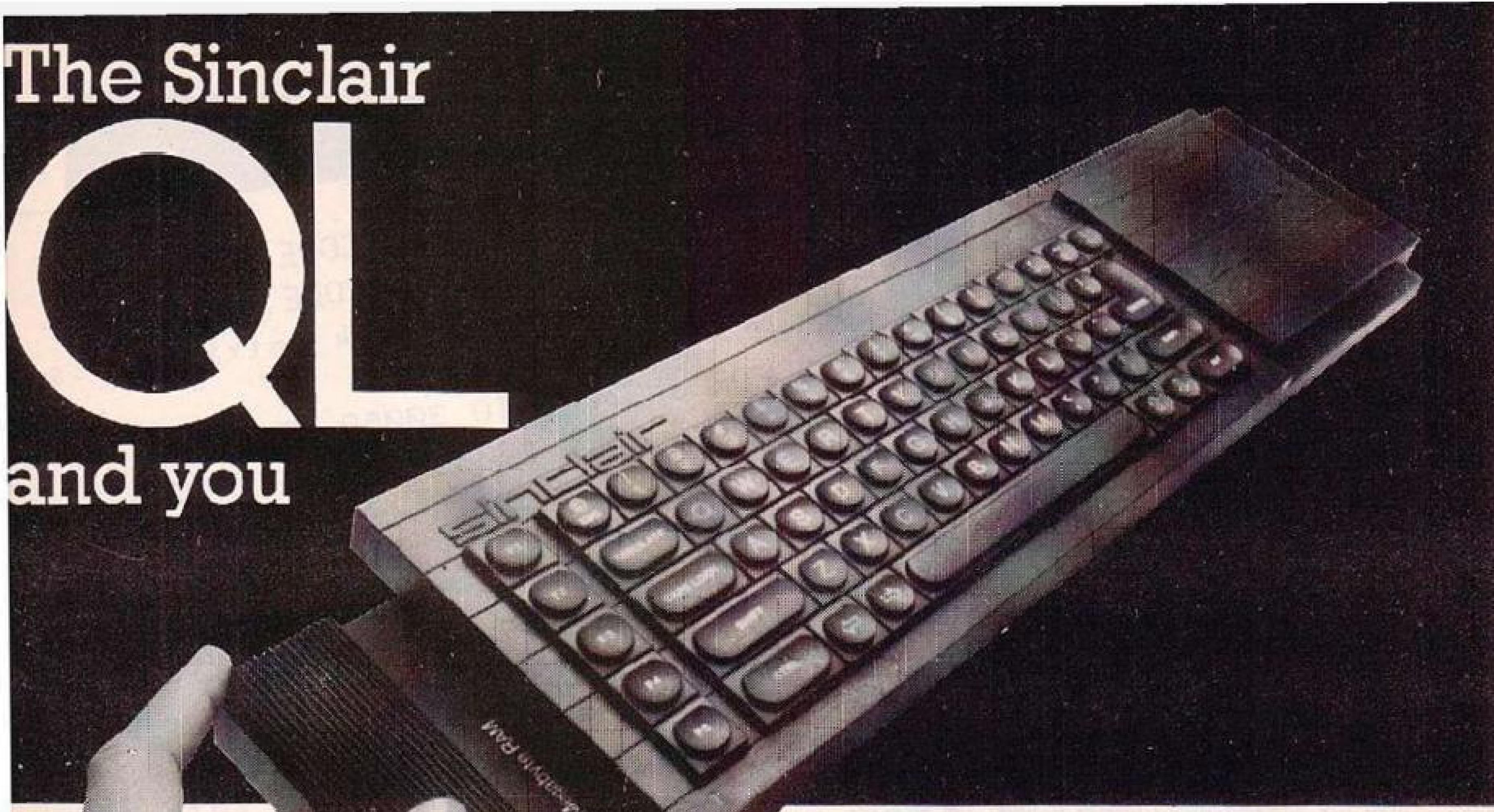
The simple little program, right, provides the new ROM entry position of the Microdrive commands. The reader can get a better understanding of the Microdrive operation by producing a disassembled listing from the start of each of these commands. The code tends to jump around but sections can be used quite easily within your own programs.

Recently, I reported that the QL Microdrives in the FB ROM machines (check by typing: Print ver$) were prone to lose programs and data by becoming unreadable. You will be pleased to hear that the latest version of the QL seems to have cured the problem which means it must have been a software problem in the old ROM.

Using the "new" QL for a period of weeks has provided the data integrity that a user would require and given a much higher level of confidence in the drives. All that remains are the two problems of excessive cartridge costs — £5 is still daylight robbery — and disappointingly long and frequent QL Microdrives accessing times especially when using the Psion software packages.

```
   1 CLEAR 30000
   2 SAVE *"m";1;"urom"CODE 435,61
   3 LOAD *"m";1;"urom"CODE 30000
   4 PRINT " Syntax check entry points":
 PRINT
   5 FOR a=30003 TO 30053 STEP 5
   6 PRINT CHR$ (206+PEEK a);: GO SUB 10
: PRINT b
   7 NEXT a
   8 PRINT : PRINT " Extend Vector Addre
ss": PRINT : LET a=a-2: GO SUB 10: PRINT
 ,(PEEK b+256*PEEK (b+1))
   9 ERASE "m";1;"urom": STOP
  10 LET b=PEEK (a+2)+256*PEEK (a+3): RE
TURN
9000 CLEAR #: FORMAT "t";600: OPEN #3;"t
": STOP
9990 ERASE "m";1;"ufile1": SAVE *"m";1;"
ufile1": CAT 1: STOP
```

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DRAGON FILES

Bernard Harmel puts the Dragon on file.

THIS PROGRAM, which is entirely in machine-code, allows you to store, search look at and save data in the form of a card-index in the memory of the computer.

The program has been realised on a Dragon 32 with the EDTASM + cartridge. It occupies 1,971 bytes and leaves approximately 29,200 bytes free for data storage. For first time loading, switch the machine off, then on, and load the decimal machine-code in listing 1 using the Basic program supplied — listing 2. A checksum is included at the end of each line to prevent errors.

After that save the code on tape as a machine-code file:

CSAVEM "$FILESS", 30920, 32400, 0

Turn the machine off, then on, and type:

```
POKE 25, 6        Enter )
NEW               Enter }   to reserve them
CLEAR 20, 1690 Enter )
```

Then you must set RAMtop. That is to say you must tell the computer from where it must note the data — min. 1,701: max. 30,900 — that is done by Poking the value 210 in he desired address. Poke 1701, 210 receive the maximum place for data storage and Poke 30900 the minimum. Finally, type:

EXEC 31921

The menu must appear on the screen. Let us suppose that we want to classify books — each book is identified by a file specifying the author, title, year, price.

We must first define a model file collecting these different pieces of information. Command 1 allows you to do that. Press 1, the screen turns green and a cursor appears in the left-hand corner of the screen. You have 10 lines to create your model file; if you try to write on the 11th you get an end of file error. Press ↑ and continue. Use the four arrow keys to move the cursor and the other keys to write. To clear a character put the cursor on the left and press ←. When data first appears after an item it must be followed by:

(CHR$(58))

For our example, the model file could be like this — use command 1 to create it.

BOOKS

AUTHOR:

TITLE: YEAR:

PRICE:
(WITHOUT VAT)

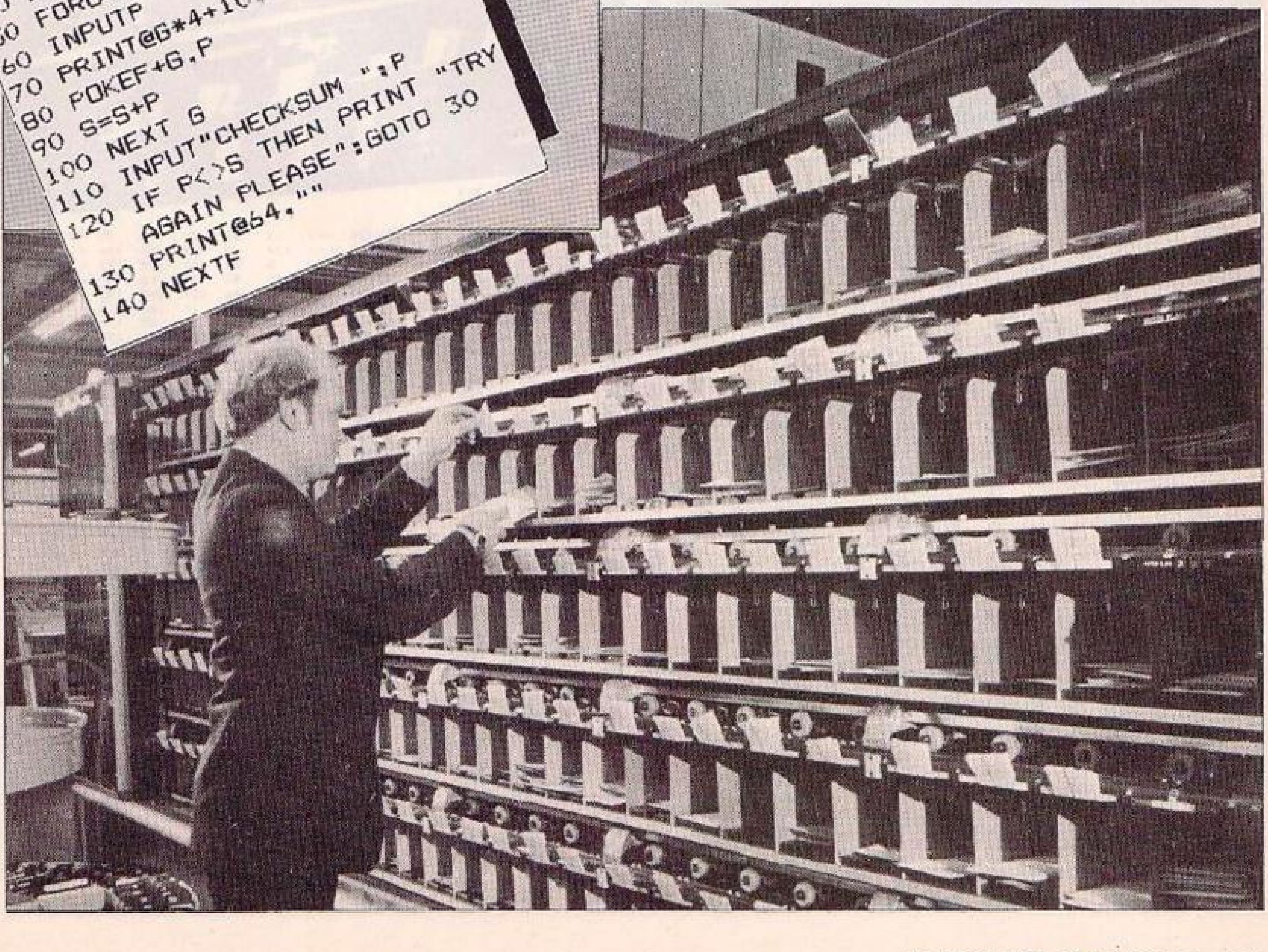
32 Columns

When the model file is finished just press Enter and the message File Recorder will appear on the screen. Press any key to return to the menu.

(continued on next page)

Listing 2 Decimal loader.

```
10 CLS
20 FOR F=30920TO32391STEP5
30 S=0:PRINT@32.""
40 PRINT@0.F;" --> "
50 FORG=0TO4
60 INPUTP
70 PRINT@G*4+10.P
80 POKEF+G.P
90 S=S+P
100 NEXT G
110 INPUT"CHECKSUM ";P
120 IF P<>S THEN PRINT "TRY
    AGAIN PLEASE":GOTO 30
130 PRINT@64.""
140 NEXTF
```



(continued from previous page)

The command allows you to complete the model file with information. Press 2 and the model file will appear. Use the arrow key to move the cursor near the items and type the information corresponding to the item between

(CHR$(34))

If an item has no information it must be followed by "". If you forget a " you will get a Syntax Error — use the arrow keys to correct.

When every item is followed by the information press Enter and you get OK? If you press:

Break: return to menu and file is recorded.

N : the file is cleared and you can write it again any other key: You record the file and make offers the model file and the cursor ready to write the next file.

Example:

BOOKS

AUTHOR: "H. G. Wells"
TITLE: "War of the Worlds" YEAR: "1964"
PRICE: "3.5"
(WITHOUT VAT)

Command 3 allows you to search a string among all the files stored in memory. Press 3 — Searching will appear at the bottom of the screen with the cursor. Type your string followed by

(CHR$(35))

and press Enter. If you make an error use ← to correct it. Example — Searching: WAR#. If the string searched is in memory the corresponding file is displayed on the screen and, at the bottom of the screen, the message 'Space' Dump to Printer. If you press:

Space: you will get a copy of the screen on the printer.

Break: return to the menu:

Any other key will make the computer continue the research.

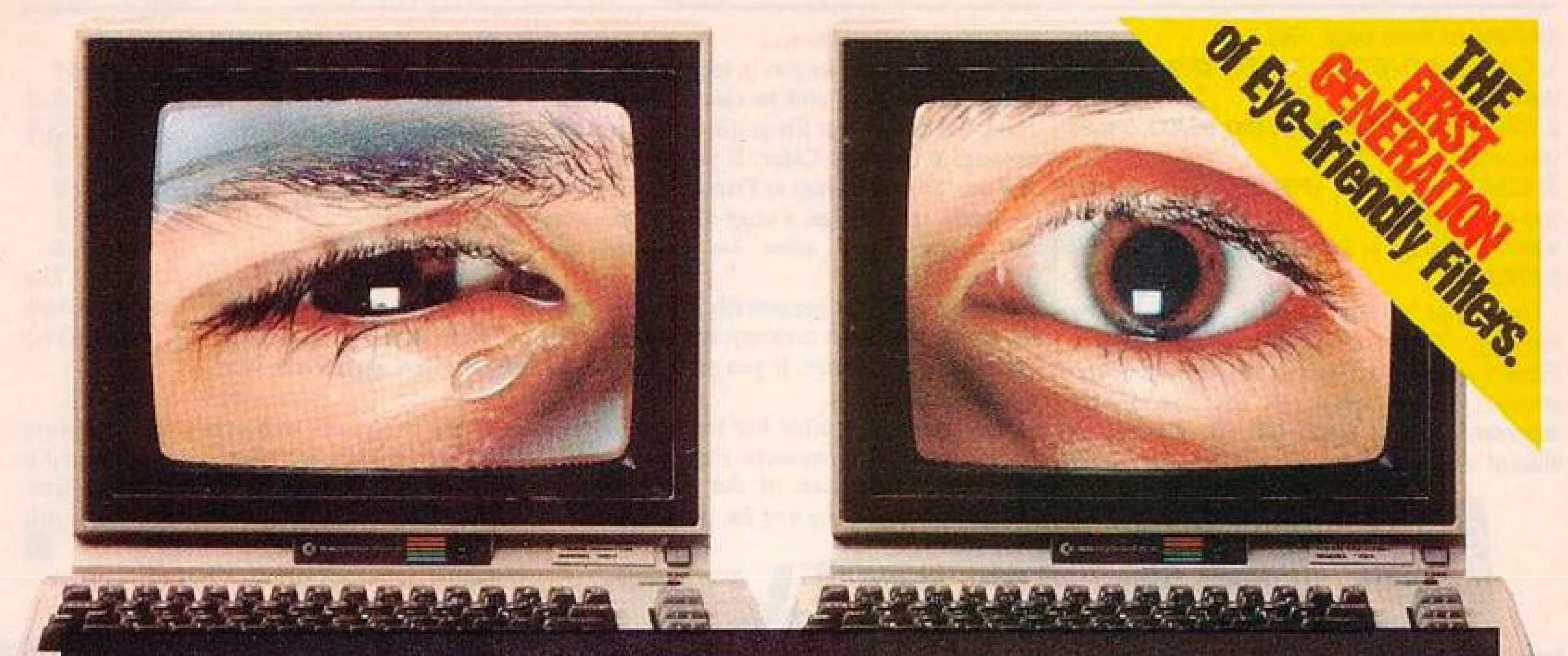
If the string is present several times in the file, it is displayed several times also. If the string isn't in memory the program displays Finished. Press a key to get the menu. Command 4 allows you to save the card index and also to leave the program. Press 4 several times and you are in Basic. You can type:

(continued on page 138)



Listing 1. Decimal dump.

```
30920 --> 70  73  76  69  32 = 320
30925 --> 8?  69  67  79  82 = 379
30930 --> 60  69  68  70  73 = 340
30935 --> 78  73  83  72  69 = 375
30940 --> 68  39  83  80  65 = 335
30945 --> 67  69  39  58  68 = 301
30950 --> 85  77  80  32  84 = 359
30955 --> 79  32  80  82  73 = 346
30960 --> 78  84  69  82  79 = 392
30965 --> 75  32  63  48  32 = 250
30970 --> 32  68  85  77  80 = 342
30975 --> 32  32  32  32  49 = 177
30980 --> 32  32  67  76  69 = 276
30985 --> 65  82  83  69  65 = 364
30990 --> 82  67  72  73  78 = 372
30995 --> 71  58  69  78  68 = 344
31000 --> 32  79  70  32  70 = 283
31005 --> 73  76  69  83  89 = 390
31010 --> 78  84  65  88  32 = 347
31015 --> 59  82  82  79  82 = 394
31020 --> 79  85  84  32  79 = 359
31025 --> 70  32  77  69  77 = 325
31030 --> 79  82  89  78  79 = 407
31035 --> 32  83  84  65  82 = 346
31040 --> 84  73  78  71  32 = 338
31045 --> 80  79  73  78  84 = 394
31050 --> 32  40  50  49  48 = 219
31055 --> 41  32  70  79  85 = 307
31060 --> 78  68 106 106 106 = 464
31065 --> 106 106 106 106 106 = 530
31070 --> 106 106 106 106 106 = 530
31075 --> 106 106 106 106 106 = 530
31080 --> 106 106 106 106 106 = 530
31085 --> 106 106 106 106 106 = 530
31090 --> 106 106 106 106 106 = 530
31095 --> 68  82  65  71  79 = 365
31100 --> 78  32  70  73  76 = 329
31105 --> 59  32  32  32  32 = 197
31110 --> 32  66  69  82  78 = 327
31115 --> 65  82  68  32  72 = 319
31120 --> 65  82  77  69  76 = 369
31125 --> 106 106 106 106 106 = 530
31130 --> 106 106 106 106 106 = 530
31135 --> 106 106 106 106 106 = 530
31140 --> 106 106 106 106 106 = 530
31145 --> 106 106 106 106 106 = 530
31150 --> 106 106 106 106 106 = 530
31155 --> 106 106 106  69  78 = 465
31160 --> 84  69  82  32  32 = 299
31165 --> 32  86  65  76  73 = 332
31170 --> 68  65  84  73  79 = 369
31175 --> 78  73  68  32  85 = 296
31180 --> 78  69  32  70  73 = 322
31185 --> 67  72  69  32  32 = 272
31190 --> 66  82  69  65  75 = 357
31195 --> 32  32  32  52  69 = 247
31200 --> 84  79  85  62  32 = 362
31205 --> 65  85  32  77  69 = 328
31210 --> 78  85 113  32  32 = 340
31215 --> 32  68  69  70  73 = 312
31220 --> 78  73  84  73  79 = 387
31225 --> 78  32  68  32  85 = 295
31230 --> 78  32  71  69  66 = 316
31235 --> 65  82  73  84  32 = 336
31240 --> 32  32  32  32 114 = 242
31245 --> 32  32  32  83  84 = 263
31250 --> 79  67  75  65  71 = 357
31255 --> 69  32  68  32  73 = 274
31260 --> 78  70  79  80  77 = 384
31265 --> 65  84  73  79  78 = 379
31270 --> 83  32  32  32  32 = 211
31275 --> 32 115  32  32  32 = 243
31280 --> 87  69  67  72  69 = 359
31285 --> 82  67  72  69  32 = 322
31290 --> 68  32  73  78  70 = 321
31295 --> 79  82  77  65  84 = 387
31300 --> 73  79  78  83  32 = 345
31305 --> 32  32  32 115  32 = 244
31310 --> 32  32  83  65  86 = 298
31315 --> 69  32  70  73  76 = 320
31320 --> 69 117  32  32  32 = 282
31325 --> 78  69  87  32  32 = 298
31330 --> 32  32  32  32  32 = 160
31335 --> 32  32  32  32  32 = 160
31340 --> 32  32  32  32  32 = 160
31345 --> 32  32  32  32  32 = 160
31350 --> 32  32  32 118  32 = 246
31355 --> 32  32  73  78  83 = 298
31360 --> 80  69  67  81  73 = 373
31365 --> 79  78  32  68  85 = 342
31370 --> 32  70  73  67  72 = 314
31375 --> 73  69  82 129  63 = 416
31380 --> 34   5 139  64 126 = 368
31385 --> 177 159 170  85  34 = 529
31390 -->  6 167 128 191 127 = 619
31395 --> 248  57 128  96 126 = 655
31400 --> 122 159 190 127 248 = 846
31405 --> 230 132 134 124 167 = 787
31410 --> 132 189 126  85 231 = 763
31415 --> 132 189 126 106 129 = 682
31420 --> 13  16  39   3  70 = 141
31425 --> 129   9  39  41 129 = 347
31430 -->  0  39  33 129  9? = 302
31435 --> 39  43 129  10  39 = 260
31440 --> 34 246 127 245 193 = 845
31445 -->  0  38  11 140   5 = 194
31450 --> 63  35   6 189 126 = 419
31455 --> 114 126 122 170 189 = 721
31460 --> 122 146 126 122 170 = 686
31465 --> 198 255 126 122 250 = 951
31470 --> 198   1 126 122 250 = 697
31475 --> 198  32 126 122 250 = 728
31480 --> 198 224  48 133 102 = 785
31485 --> 127 245 129   0  38 = 539
31490 --> 11 140   5  63  35 = 254
31495 -->  5 189 126 114 126 = 560
31500 --> 122 170 140   4   0 = 436
31505 --> 37  11 191 127 248 = 614
31510 --> 193 255  38   4 198 = 688
31515 --> 96 231 132 126 122 = 707
31520 --> 173 142   4   0 127 = 443
31525 --> 127 254  16 190 127 = 714
31530 --> 250  16 191 127 252 = 836
31535 --> 166 128 140   5  63 = 502
31540 --> 34  87 129  98  38 = 386
31545 --> 245 246 127 254 193 = 1065
31550 -->  5  38   ? 198 134 = 377
31555 --> 231 160 124 127 254 = 896
31560 --> 166 128 140   5  63 = 502
31565 --> 37  27 185 125 123 = 501
31570 --> 16 190 127 252  16 = 601
31575 --> 191 127 250 139 126 = 883
31580 --> 85 142   4   0 191 = 422
31585 --> 127 248 185 122 170 = 856
31590 --> 126 123  33  57 129 = 468
31595 --> 98  39  20 157 160 = 484
31600 --> 16 140 120 130  37 = 493
31605 --> 210 189 125 132 189 = 845
31610 --> 126  85 126 124 198 = 659
31615 --> 126 123  72 134 128 = 583
31620 --> 167 160  16 171 127 = 661
31625 --> 250 126 123  47 134 = 680
31630 --> 210 167 164 189 123 = 853
31635 --> 228 142   4   0  16 = 390
31640 --> 190 127 252 166 128 = 863
31645 --> 140   5  63  35  43 = 286
31650 --> 246 127 255 193   0 = 821
```



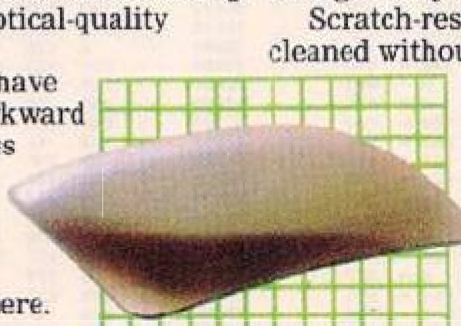
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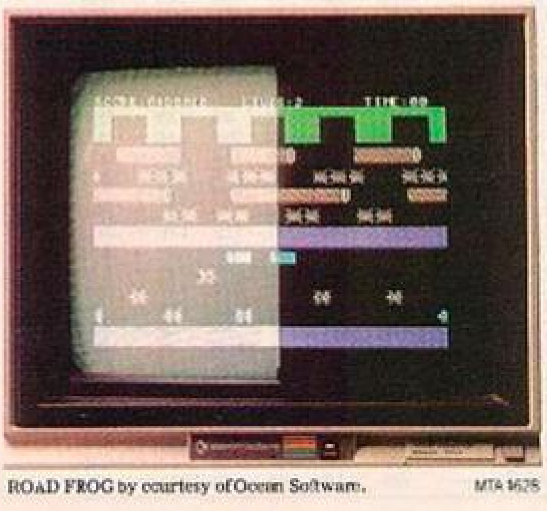


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(continued from page 136)

1. CSAVEM "MODEL", 32420, 32740, 0 save the model file.

2. CSAVEM "$FILES$", 30920, 32400, 0 save the program.

3. CSAVEM "FILE", 1700, RAMTOP, 0 save the card-index.

where RAMtop = 256*PEEK(32762) + PEEK (32763).

Command 5 allows you to reset the memory. This command is error trapped. Press 5 — OK? appears at the bottom of the screen. If you press O (not zero) this command is executed. All the memory is cleared and RAMtop is set at 1700. Any other returns you to the menu.

Command 6 allows you to look at your card-index sequentially and to clear certain files. Press 6 and the first file is displayed with the message 0 Dump 1 Clear. If you press 0 you will see 'Space': Dump to Printer. If you press — Space: you will get a copy of the screen on the printer. Any other key displays the following file.

If you press 1 the present file is cleared from the screen and from memory and the next file appears on the screen. If you press Break you return to the menu.

If you press any other key the next file will be displayed. The message Finished appears when the exploration of the card index is terminated. Press any key for the menu.

Messages.

File recorded	see command 1
Finished	" " 3, 6
'Space: Dump to Printer	" " 3, 6
OK?	" " 2
O dump and clear	" " 6
End of File	" " 1
Syntax Error	" " 2
Out of Memory	" " The memory is full.

The message No Starting Point (210) Found can appear after an

EXEC31921

The program explores the memory searching RAMtop (210): if it doesn't find it it displays that message. When you load a card-index again you must not set RAMtop — it is automatic. ■



(decimal dump continued from page 136)

31655	-->	16	38	2	92	16	=	163
31660	-->	142	170	244	198	4	=	703
31665	-->	189	125	147	189	126	=	776
31670	-->	85	129	78	38	9	=	339
31675	-->	190	127	252	191	127	=	887
31680	-->	250	126	125	75	129	=	705
31685	-->	3	16	39	0	252	=	310
31690	-->	126	125	75	129	122	=	577
31695	-->	38	202	166	160	129	=	695
31700	-->	128	39	196	129	210	=	702
31705	-->	39	208	129	134	39	=	549
31710	-->	242	167	128	126	123	=	786
31715	-->	209	16	142	4	0	=	371
31720	-->	142	126	164	166	128	=	726
31725	-->	167	160	16	140	5	=	488
31730	-->	63	35	246	57	189	=	590
31735	-->	126	93	189	122	170	=	700
31740	-->	142	4	0	16	142	=	304
31745	-->	176	164	166	128	167	=	78.
31750	-->	160	140	5	64	37	=	406
31755	-->	247	16	142	120	200	=	725
31760	-->	198	13	189	125	147	=	672
31765	-->	189	126	85	126	124	=	650
31770	-->	177	189	126	93	16	=	601
31775	-->	142	120	244	198	4	=	708
31780	-->	189	125	147	189	126	=	776
31785	-->	85	129	79	16	38	=	347
31790	-->	0	150	142	6	164	=	462
31795	-->	134	210	167	128	140	=	779
31800	-->	120	180	37	249	126	=	712
31805	-->	124	177	142	6	165	=	614
31810	-->	191	127	252	189	126	=	885
31815	-->	93	190	127	252	191	=	853
31820	-->	127	246	189	126	106	=	794
31825	-->	166	132	129	210	16	=	653
31830	-->	39	3	162	191	127	=	522
31835	-->	252	124	127	255	189	=	947
31840	-->	123	145	127	127	255	=	777
31845	-->	16	191	127	252	16	=	602
31850	-->	147	170	248	198	19	=	782
31855	-->	189	125	147	189	126	=	776
31860	-->	85	129	3	16	39	=	272
31865	-->	1	140	129	48	38	=	356
31870	-->	6	189	126	8	126	=	455
31875	-->	124	72	129	49	39	=	413
31880	-->	3	126	124	72	190	=	515
31885	-->	127	246	16	190	127	=	706
31890	-->	252	191	127	252	166	=	988
31895	-->	160	167	128	16	140	=	611
31900	-->	120	180	37	246	189	=	772
31905	-->	126	121	48	31	191	=	517
31910	-->	127	250	190	127	249	=	943
31915	-->	191	127	252	126	124	=	820
31920	-->	72	189	126	121	135	=	643
31925	-->	120	180	16	36	0	=	352
31930	-->	210	48	31	191	127	=	607
31935	-->	250	127	127	245	127	=	876
31940	-->	127	255	134	128	142	=	785
31945	-->	4	0	191	127	248	=	570
31950	-->	167	128	140	6	0	=	441
31955	-->	38	249	142	4	0	=	433
31960	-->	16	142	121	86	198	=	563
31965	-->	96	189	125	8	142	=	560
31970	-->	4	128	16	142	121	=	411
31975	-->	182	198	54	189	125	=	748
31980	-->	8	48	136	42	16	=	250
31985	-->	142	121	236	198	109	=	806
31990	-->	189	125	8	48	136	=	506
31995	-->	19	16	142	122	09	=	308
32000	-->	198	57	189	125	8	=	577
32005	-->	126	125	26	166	160	=	603
32010	-->	129	32	38	2	134	=	335
32015	-->	192	128	64	167	128	=	679
32020	-->	90	193	0	38	239	=	560
32025	-->	57	109	126	85	129	=	506
32030	-->	49	16	39	254	211	=	569
32035	-->	129	50	39	6	189	=	417
32040	-->	125	75	126	124	198	=	648
32045	-->	129	51	38	6	189	=	413
32050	-->	125	94	126	124	198	=	667
32055	-->	129	52	39	48	129	=	397
32060	-->	53	16	39	254	218	=	580
32065	-->	129	54	38	213	189	=	623
32070	-->	124	63	126	124	198	=	635
32075	-->	189	126	93	189	123	=	720
32080	-->	228	142	4	0	191	=	565
32085	-->	127	248	189	122	170	=	856
32090	-->	189	123	33	57	189	=	591
32095	-->	126	93	124	127	245	=	715
32100	-->	189	125	161	127	127	=	729
32105	-->	245	57	189	126	121	=	738
32110	-->	191	127	250	57	16	=	641
32115	-->	142	121	21	198	11	=	493
32120	-->	176	175	147	16	142	=	656
32125	-->	121	32	193	12	126	=	489
32130	-->	125	147	16	142	121	=	551
32135	-->	44	198	13	126	125	=	506
32140	-->	147	16	142	121	57	=	483
32145	-->	198	29	142	5	64	=	438
32150	-->	166	160	189	122	146	=	783
32155	-->	90	193	0	38	246	=	567
32160	-->	57	16	142	121	11	=	347
32165	-->	198	10	142	5	96	=	451
32170	-->	189	125	150	191	127	=	782
32175	-->	236	189	122	170	142	=	859
32180	-->	6	165	16	190	127	=	504
32185	-->	236	230	160	193	99	=	918
32190	-->	39	33	16	140	5	=	233
32195	-->	255	36	181	247	127	=	846
32200	-->	240	166	128	129	210	=	873
32205	-->	39	44	177	127	240	=	627
32210	-->	39	230	126	125	182	=	702
32215	-->	191	127	242	166	130	=	856
32220	-->	129	134	38	250	48	=	599
32225	-->	1	191	127	252	124	=	695
32230	-->	127	255	189	123	145	=	839
32235	-->	127	127	255	189	126	=	824
32240	-->	8	129	3	39	18	=	197
32245	-->	190	127	242	126	125	=	810
32250	-->	102	16	142	120	213	=	673
32255	-->	190	0	189	123	147	=	667
32260	-->	189	126	85	57	16	=	473
32265	-->	142	120	221	198	23	=	704
32270	-->	189	125	147	189	126	=	776
32275	-->	85	129	33	39	1	=	287
32280	-->	189	126	106	57	142	=	620
32285	-->	4	0	127	127	244	=	502
32290	-->	246	127	244	193	31	=	841
32295	-->	34	36	174	177	244	=	665
32300	-->	166	128	140	5	63	=	502
32305	-->	34	12	129	95	37	=	308
32310	-->	2	128	64	189	128	=	511
32315	-->	15	126	126	34	134	=	435
32320	-->	13	189	128	15	189	=	534
32325	-->	128	15	189	123	15	=	475
32330	-->	126	126	24	134	13	=	423
32335	-->	189	128	15	126	126	=	584
32340	-->	31	189	128	6	129	=	483
32345	-->	0	39	249	57	142	=	487
32350	-->	4	0	198	96	231	=	529
32355	-->	128	140	6	0	37	=	311
32360	-->	249	57	16	142	5	=	469
32365	-->	64	198	96	231	160	=	749
32370	-->	16	140	5	96	37	=	294
32375	-->	248	57	142	6	164	=	617
32380	-->	166	120	140	128	180	=	734
32385	-->	36	4	129	210	38	=	417
32390	-->	245	57	255	255	255	=	1067


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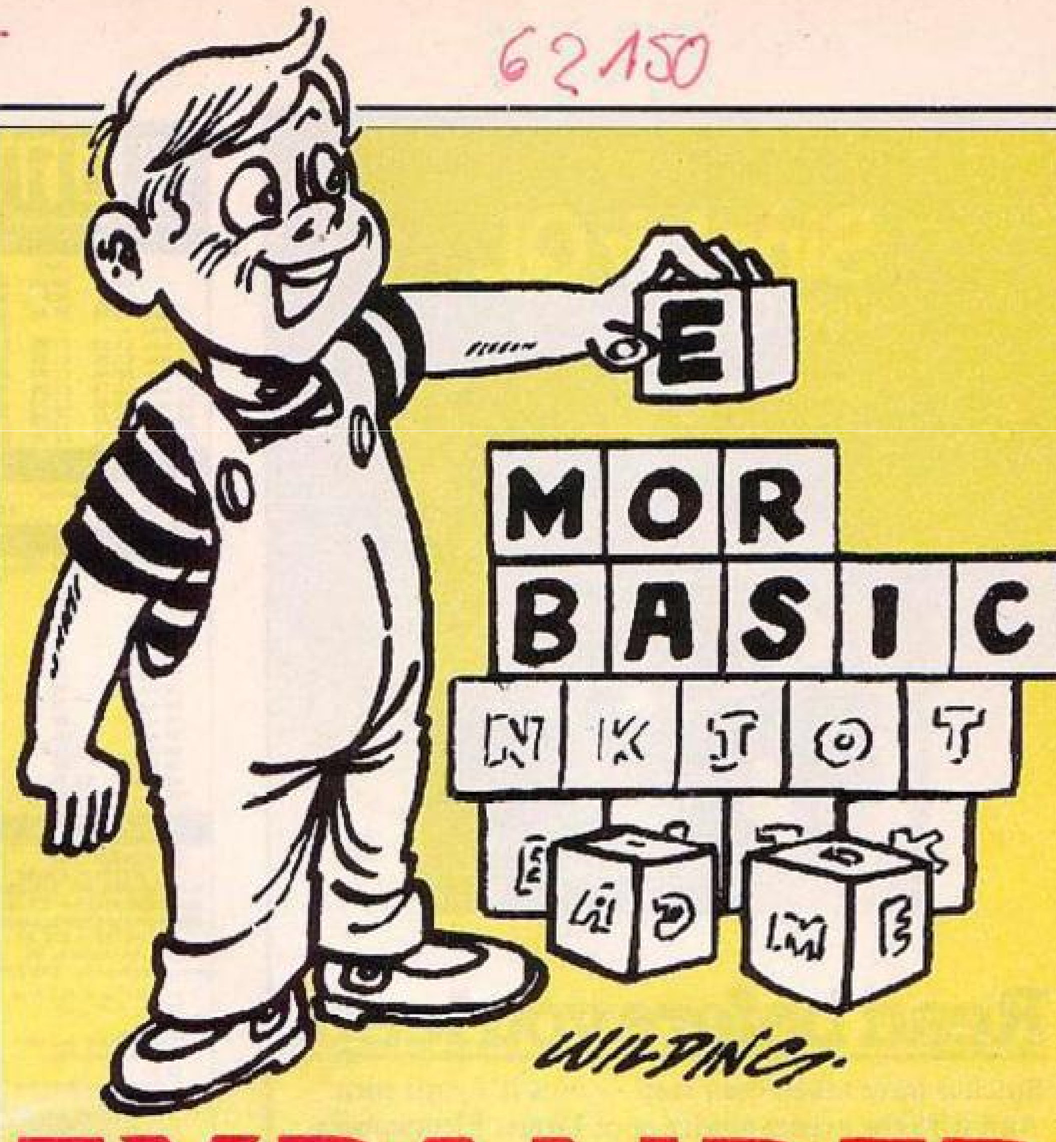
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A short Basic program, listing 1 (16K) or listing 2 (48K), is used to load the machine code above RAMtop, and perform the initialisation. This program should be typed in, and then saved on a cassette or Microdrive cartridge to auto-run from Line 3. If you use a Microdrive, the program can be given the filename "run", ie:

SAVE *"m";1;"run" LINE 3 or
SAVE "BASIC+" LINE 3

New the computer, then type in and Run listing 3, the machine code loader program. Copy the machine code bytes from either listing 4 or 5 depending upon memory size. Great care must be taken while copying from the machine code dump, since a single mistake could cause the computer to crash.

You should now have a working copy of the Basic+ interpreter. To test it, rewind the tape and clear the computer by typing Randomise USR 0. Then load the initialisation program and machine code, and type *ZAP which should produce a laser type sound effect.

Graphic characters

*USE (Nchars), (Memory): (Nchars) is the number of different graphic characters that you want to use, and can take values from 1 to 255. (Memory) is the memory size in bytes needed for storing those characters. To calculate the number of bytes required to store each character, divide its width by 8, and add 1 for any remainder, then multiply by its height.

This command causes part of the memory to be reserved for the storage of your graphics characters. The total number of bytes required is (Memory) + (Nchars)*4 bytes. For example, the command *USE 8,256 reserves 288 bytes. If you try to reserve more memory for your graphics than the spare memory available, this will halt your program with a runtime error.

The graphics memory area is situated just before the start of the machine code. If necessary, RAMtop will be lowered — and the machine stack and Gosub stack moved — to make room for the graphics memory. The routine will only lower RAMtop, and never moves it to a higher address. This is to allow your own machine-code routines to be used with extended Basic provided that they are located between the graphics memory and RAMtop.

The *Use command clears the graphics memory and character-size definitions — see *Def — and can be used more than once in a program for this purpose. If there is no *Use command in a program, the command *USE 8,256 is assumed by the routine.

*DEF (Char), (Width), (Ht): After *Use, the *Def command is used to set the size of a graphics character. (Char) is the character number, which can take values from 1 to (Nchars). (Width) and (Ht) are the sizes of this character in pixels — from 1 to 256 pixels wide, and from 1 to 176 pixels high. You must set the size of a character before using it in one of the remaining commands, which are:—

*GET (char), (xpos), (ypos)
*PUT (char), (xpos), (ypos)
*CLR (char), (xpos), (ypos)

Lines 2,3 and 4 of the initialisation program can be deleted once the machine code has

(continued on page 143)

Listing 1. 16K initialisation.

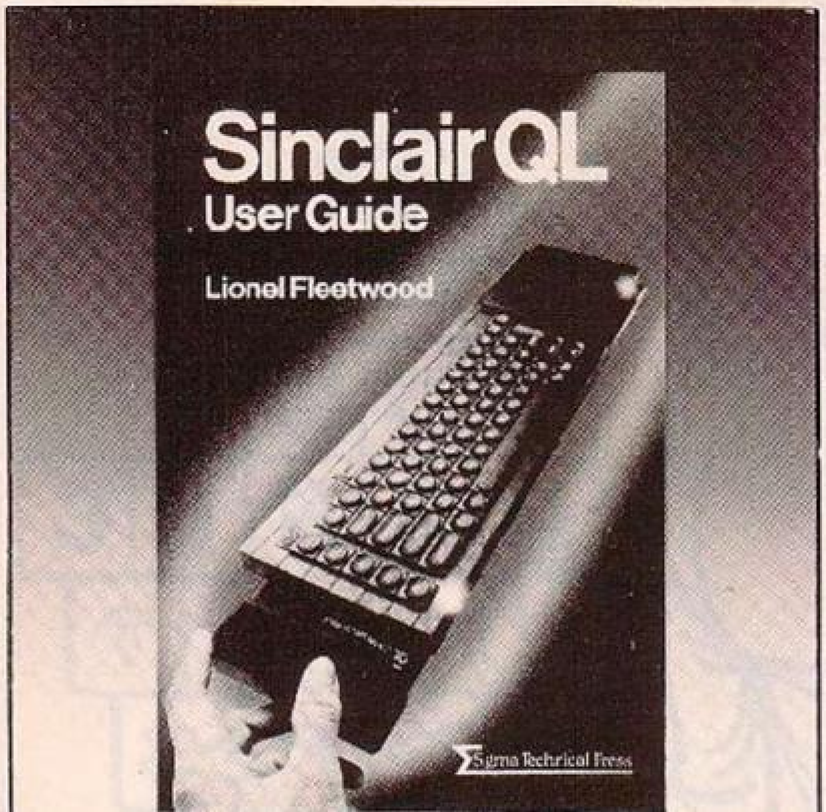
```
1 POKE PEEK 23613+256*PEEK 23614,206: POKE 1+PEEK
  23613+256*PEEK 23614,PEEK 23733-6
2 GO TO 4
3 CLEAR 31151: LOAD "16KMC" CODE : GO TO 1
4 CLS : PRINT "16K BASIC+ (C) Robert Newman 1984"
```

Listing 2. 48K initialisation.

```
1 POKE PEEK 23613+256*PEEK 23614,206: POKE
  1+PEEK 23613+256*PEEK 23614,PEEK 23733-6
2 GO TO 4
3 CLEAR 63899: LOAD "48KMC' CODE : GO TO 1
4 CLS : PRINT '48K BASIC+ (C)
  Robert Newman 1984"
```

Listing 3. Machine code loader.

```
  1 REM listing 3
 10 CLEAR 31131+32768*(PEEK 23733=255)
 20 LET K48=(PEEK 23733=255)
 30 LET mc=31132+32768*K48
 40 FOR j=mc TO mc+22: POKE j,0: NEXT j
 50 LET sum=0
 60 FOR j=mc+23 TO mc+1464
 70 PRINT j;TAB 7;
 80 INPUT n: POKE j,n
 90 PRINT n: LET sum=sum+n
100 NEXT j
110 LET checksum=161457+(16128 AND K48)
120 IF sum<>checksum THEN PRINT "Checksum error": STOP
130 LET a$=("16KMC" AND NOT K48)+("48KMC" AND K48)
140 SAVE a$ CODE mc,1465
150 REM or SAVE *"m";1;a$ CODE mc,1465
```



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(continued from page 141)

loaded, but you must not delete line 1, otherwise none of the new commands will be recognised when you Run your program.

During runtime, if the command cannot be executed, the error message produced is code Q — "Parameter error."

*BRK 0 and *BRK 1: These commands allow the break key to be disabled (*BRK 0), or re-enabled (*BRK 1).

*ZAP: This command gives a laser-type zap sound.

*NSE (Length): This command gives white noise for a time depending upon (Length) which can take values from 1 to 255. Depending upon the length, this can sound like an explosion, gunshot etc. A machine-gun type sound can be made using a loop — eg., FOR j = 1 TO 10: *NSE 50: PAUSE 10: NEXT j

*SCR (Paper), (Ink): This command changes the Paper and Ink colours of the screen without erasing its contents. Paper and Ink can take values from 0 to 9 as with the normal colour commands.

The remaining commands are concerned with printing of user-defined graphics. These can be copied from the screen into graphics memory with *Get and then printed anywhere on the screen with *Put. The routine can handle graphics of any size from 1 by 1 pixels to 256 by 176 pixels, and caters for up to 255 different graphics characters.

First, you need to decide how much memory you want to set aside for the storage of graphics characters. This is done with the *Use command.

In all three commands, (Char) is the character number — the size of which must have previously been defined with *Def. (Xpos) and (Ypos) are the pixel co-ordinates of a point on the screen at the top left hand corner of the area from where the graphic character information is to be copied from, printed to, or erased.

(continued on next page)

Listing 4. 16K machine code dump.

31155:	98	114	107	115	99	114	110	115	101	102	97	112	117	115
31169:	101	99	108	114	117	117	116	105	101	116	106	101	102	58
31183:	58	92	254	11	40	19	254	12	40	5	254	27	194	147
31197:	122	253	205	118	126	202	147	122	195	12	124	42	93	92
31211:	43	126	254	42	194	147	122	221	37	179	121	17	3	0
31225:	6	9	223	205	239	221	190	0	40	7	221	25	16	247
31239:	195	147	122	120	50	176	121	6	2	221	35	123	207	239
31253:	221	190	0	32	121	16	244	231	58	176	121	254	9	40
31267:	55	254	8	40	26	254	7	40	26	254	6	40	60	254
31281:	5	40	14	205	251	36	253	203	1	118	40	86	254	44
31295:	32	82	231	205	251	36	253	203	1	118	40	72	254	44
31309:	32	68	231	205	251	36	253	203	1	118	40	58	24	18
31323:	225	254	48	56	51	254	58	48	47	253	203	1	126	194
31337:	20	123	231	223	254	13	40	8	253	54	0	11	254	58
31351:	32	26	253	206	1	126	194	39	123	253	54	0	255	253
31365:	54	38	0	33	206	121	229	33	183	18	229	195	118	27
31379:	253	203	1	126	32	13	33	205	121	229	42	93	92	34
31393:	95	92	195	183	18	118	253	203	1	174	253	203	48	78
31407:	176	200	14	58	58	92	60	245	33	0	0	253	116	55
31421:	253	116	58	34	11	92	35	34	22	92	205	176	22	253
31435:	203	55	174	205	110	13	253	203	2	238	241	71	254	10
31449:	56	2	198	7	205	239	21	62	32	215	120	17	145	19
31463:	205	10	12	175	17	54	21	205	10	12	237	75	69	92
31477:	205	27	26	62	58	215	253	78	13	6	0	205	27	26
31491:	205	151	16	58	58	92	253	54	0	255	33	206	121	229
31505:	195	104	19	79	231	254	13	40	4	254	88	32	136	121
31519:	214	49	50	176	92	195	12	124	253	54	0	25	58	176
31533:	121	254	8	40	46	254	6	40	112	48	104	254	5	40
31547:	93	254	1	40	56	205	50	127	254	176	219	156	122	50
31561:	167	121	205	50	127	50	166	121	205	62	127	61	253	190
31575:	119	210	166	122	50	165	121	24	73	205	50	127	254	10
31589:	210	166	122	50	166	121	205	50	127	254	10	210	166	122
31603:	50	165	121	24	46	205	62	127	254	177	210	156	122	50
31617:	167	121	205	73	127	11	120	167	194	166	122	12	121	50
31631:	166	121	205	62	127	50	165	121	24	13	205	73	127	237
31645:	67	166	121	205	62	127	50	165	121	221	33	156	121	58
31659:	176	121	61	202	252	124	61	202	153	125	61	232	41	126
31673:	61	202	55	126	61	202	110	125	61	40	53	61	40	84
31687:	42	141	92	34	143	92	58	165	121	254	0	40	5	87
31701:	167	205	53	34	58	166	121	254	8	40	5	87	55	205
31715:	53	34	205	173	28	58	141	92	33	0	88	17	1	88
31729:	1	255	2	117	237	176	24	19	33	0	6	17	1	0
31743:	229	205	181	3	225	17	32	0	167	237	82	32	240	253
31757:	54	0	255	253	54	38	0	33	206	121	229	175	118	27
31771:	243	58	165	121	79	6	0	203	33	203	16	203	33	203
31785:	16	58	72	92	15	15	15	8	33	0	0	8	211	254
31799:	238	16	8	235	99	46	10	183	237	82	41	41	25	35
31813:	125	61	72	253	11	120	177	32	230	251	195	12	124	22
31827:	78	9	6	0	205	33	203	16	203	33	203	16	9	20
31841:	127	82	46	78	101	119	109	97	110	49	57	56	52	42
31855:	166	121	208	83	124	210	166	122	34	177	121	17	244	1
31869:	25	218	166	122	235	33	156	121	237	75	101	92	167	237
31883:	66	237	82	218	166	122	237	91	177	121	33	156	121	167
31897:	237	82	34	161	121	34	159	121	237	91	166	121	237	83
31911:	157	121	35	34	163	121	58	165	121	50	156	121	50	177
31925:	92	42	161	121	43	237	91	178	92	167	237	82	40	35
31939:	235	237	91	61	92	167	237	82	35	77	68	42	161	121
31953:	167	237	66	34	61	92	249	51	51	235	237	176	42	161
31967:	121	43	54	178	92	42	161	121	93	84	19	237	75	177
31981:	121	175	119	237	176	58	176	121	254	5	202	12	124	24
31995:	34	221	53	9	58	177	92	167	32	43	58	165	121	50
32009:	170	121	42	166	121	34	171	121	221	54	9	8	33	0
32023:	1	34	166	121	195	110	124	58	170	121	221	190	0	210
32037:	166	122	50	165	121	42	171	121	34	166	121	42	163	121
32051:	205	82	124	34	177	121	35	126	167	40	17	221	190	11
32065:	194	166	122	43	126	221	190	10	194	166	122	195	12	124
32079:	58	166	121	61	203	63	203	63	203	63	60	33	0	0
32093:	221	94	11	22	0	203	63	48	1	25	203	35	203	18
32107:	167	32	244	235	213	42	157	121	237	82	209	218	166	122
32121:	34	157	121	42	177	121	58	166	121	119	35	58	167	121
32135:	119	35	237	75	159	121	113	35	112	105	96	25	34	159
32149:	121	195	12	124	58	177	92	167	202	166	122	42	163	121
32163:	205	82	124	126	50	168	121	35	126	167	202	166	122	35
32177:	94	35	86	235	237	75	166	121	245	197	229	221	113	17
32191:	205	170	34	71	79	167	126	235	225	40	4	203	39	16
32205:	252	203	39	203	22	4	12	8	58	168	121	184	40	43
32219:	221	52	17	32	21	237	67	177	121	193	197	14	0	225
32233:	205	170	34	126	8	235	237	75	177	121	24	8	62	7
32247:	161	32	7	19	26	8	62	7	160	32	1	35	8	24
32261:	200	120	237	68	230	7	40	5	71	203	58	16	252	35
32275:	193	5	62	255	184	32	2	6	175	241	61	32	153	195
32289:	12	124	221	54	14	0	24	4	221	54	14	1	58	177
32303:	92	167	202	166	122	42	166	121	205	82	124	126	50	168
32317:	121	35	126	167	202	166	122	221	203	14	70	40	7	35
32331:	94	35	86	235	24	7	35	175	121	221	54	19	0	245
32345:	229	253	203	2	134	205	77	13	253	203	2	198	225	241
32359:	237	75	166	121	221	54	18	1	245	197	229	221	113	17
32373:	205	170	34	221	253	58	70	46	5	245	215	229	205	219
32387:	11	225	209	241	71	79	167	126	235	225	40	2	7	16
32401:	252	203	6	23	4	12	8	58	168	121	184	40	81	223
32415:	92	17	32	36	8	18	237	67	177	121	193	197	14	0
32429:	225	205	170	34	221	205	18	70	40	7	215	229	205	212
32443:	11	225	209	126	8	235	237	75	177	121	24	25	62	7
32457:	161	32	20	8	16	19	26	8	221	203	18	70	40	9
32471:	225	213	229	205	219	11	225	209	235	62	7	160	32	7
32485:	221	203	4	70	40	1	35	8	24	165	221	54	18	0
32499:	221	203	4	70	40	12	129	237	68	230	7	40	5	71
32513:	203	6	16	252	35	121	237	68	230	7	40	7	71	8
32527:	7	16	252	24	1	8	18	153	5	62	255	184	32	2
32541:	6	175	52	7	120	254	7	32	4	221	54	18	1	241
32555:	61	194	111	126	195	12	124	205	213	85	56	2	32	1
32569:	201	225	195	166	122	205	213	45	56	247	32	245	167	40
32583:	242	241	205	161	41	56	236	32	254	120	177	40	230	206

Checksum = 161457

Listing 5. 48K machine code dump.

63923:	98	114	107	115	99	114	110	115	101	102	97	112	117	115
63937:	101	99	108	114	117	117	116	105	101	116	106	101	102	58
63951:	58	92	254	11	40	19	254	12	40	5	251	27	194	147
63965:	250	251	205	118	126	202	147	250	195	12	252	42	93	92
63979:	43	126	254	42	194	147	250	221	37	179	249	17	3	0
63993:	6	9	223	205	239	221	190	0	40	7	221	25	16	247
64007:	195	147	250	120	50	176	249	6	2	221	35	251	207	239
64021:	221	190	8	32	121	16	244	231	58	176	249	254	9	40
64035:	55	254	8	40	26	254	7	40	26	254	6	40	60	254
64049:	5	40	14	205	251	36	253	203	1	118	40	86	254	44
64063:	32	82	231	205	251	36	253	203	1	118	40	72	254	44
64077:	32	68	231	205	251	36	253	203	1	118	40	58	24	18
64091:	225	254	48	56	51	254	58	48	47	253	203	1	126	194
64105:	20	251	231	223	254	13	40	8	253	54	0	11	254	58
64119:	32	26	253	206	1	126	194	39	251	253	54	0	255	253
64133:	54	38	0	33	206	249	229	33	183	18	229	195	118	27
64147:	253	203	1	126	32	13	33	205	249	229	42	93	92	34
64161:	95	92	195	183	18	118	253	203	1	174	253	203	48	78
64175:	176	200	14	58	58	92	60	245	33	0	0	253	116	55
64189:	253	116	58	34	11	92	35	34	22	92	205	176	22	253
64203:	203	55	174	205	110	13	253	203	2	238	241	71	254	10
64217:	56	2	198	7	205	239	21	62	32	215	120	17	145	19
64231:	205	10	12	175	17	54	21	205	10	12	237	75	69	92
64245:	205	27	26	62	58	215	253	78	13	6	0	205	27	26
64259:	205	151	16	58	58	92	253	54	0	255	33	206	249	229
64273:	195	104	19	79	231	254	13	40	4	254	88	32	136	121
64287:	214	45	50	176	92	195	12	252	253	54	0	25	58	176
64301:	249	254	8	40	46	254	6	40	112	48	104	254	5	40
64315:	93	254	1	40	56	205	50	255	254	176	219	156	250	50
64329:	167	249	205	50	255	50	166	249	205	62	255	61	253	190
64343:	119	210	166	250	50	165	249	24	70	205	50	255	254	10
64357:	210	166	250	50	166	249	205	50	255	254	10	210	166	250
64371:	50	165	249	24	46	205	62	255	254	177	210	156	250	50
64385:	167	249	205	73	255	11	120	167	194	166	250	12	121	50
64399:	166	249	205	62	255	50	165	249	24	13	205	73	255	237
64413:	67	166	249	205	62	255	50	165	249	221	33	156	249	58
64427:	176	249	61	202	252	252	61	202	153	253	61	232	41	254
64441:	61	202	55	254	61	202	110	253	61	40	53	61	40	84
64455:	42	141	92	34	143	92	58	165	249	254	0	40	5	87
64469:	167	205	53	34	58	166	249	254	8	40	5	87	55	205
64483:	53	34	205	173	28	58	141	92	33	0	88	17	1	88
64497:	1	255	2	117	237	176	24	19	33	0	6	17	1	0
64511:	229	205	181	3	225	17	32	0	167	237	82	32	240	253
64525:	54	0	255	253	54	38	0	33	206	249	229	175	118	27
64539:	243	58	165	249	79	6	0	203	33	203	16	203	33	203
64553:	16	58	72	92	15	15	15	8	33	0	0	8	211	254
64567:	238	16	8	235	99	46	10	183	237	82	41	41	25	35
64581:	125	61	72	253	11	120	177	32	230	251	195	12	252	22
64595:	78	9	6	0	205	33	203	16	203	33	203	16	9	20
64609:	127	82	46	78	101	119	109	97	110	49	57	56	52	42
64623:	166	249	208	83	252	210	166	250	34	177	249	17	244	1
64637:	25	218	166	250	235	33	156	249	237	75	101	92	167	237
64651:	66	237	82	218	166	250	237	91	177	249	33	156	249	167
64665:	237	82	34	161	249	34	159	249	237	91	166	249	237	83
64679:	157	249	35	34	163	249	58	165	249	50	156	249	50	177
64693:	92	42	161	249	43	237	91	178	92	167	237	82	40	35
64707:	235	237	91	61	92	167	237	82	35	77	68	42	161	249
64721:	167	237	66	34	61	92	249	51	51	235	237	176	42	161
64735:	249	43	54	178	92	42	161	249	93	84	19	237	75	177
64749:	249	175	119	237	176	58	176	249	254	5	202	12	252	24
64763:	34	221	53	9	58	177	92	167	32	43	58	165	249	50
64777:	170	249	42	166	249	34	171	249	221	54	9	8	33	0
64791:	1	34	166	249	195	110	252	58	170	249	221	190	0	210
64805:	166	250	50	165	249	42	171	249	34	166	249	42	163	249
64819:	205	82	252	34	177	249	35	126	167	40	17	221	190	11
64833:	194	166	250	43	126	221	190	10	194	166	250	195	12	252
64847:	58	166	249	61	203	63	203	63	203	63	60	33	0	0
64861:	221	94	11	22	0	203	63	48	1	25	203	35	203	18
64875:	167	32	244	235	213	42	157	249	237	82	209	218	166	250
64889:	34	157	249	42	177	249	58	166	249	119	35	58	167	249
64903:	119	35	237	75	159	249	113	35	112	105	96	25	34	159
64917:	249	195	12	252	58	177	92	167	202	166	250	42	163	249
64931:	205	82	252	126	50	168	249	35	126	167	202	166	250	35
64945:	94	35	86	235	237	75	166	249	245	197	229	221	113	17
64959:	205	170	34	71	79	167	126	235	225	40	4	203	39	16
64973:	252	203	39	203	22	4	12	8	58	168	249	184	40	43
64987:	221	52	17	32	21	237	67	177	249	193	197	14	0	225
65001:	205	170	34	126	8	235	237	75	177	249	24	8	62	7
65015:	161	32	7	19	26	8	62	7	160	32	1	35	8	24
65029:	200	120	237	68	230	7	40	5	71	203	58	16	252	35
65043:	193	5	62	255	184	32	2	6	175	241	61	32	153	195
65057:	12	252	221	54	14	0	24	4	221	54	14	1	58	177
65071:	92	167	202	166	250	42	166	249	205	82	252	126	50	168
65085:	249	35	126	167	202	166	250	221	203	14	70	40	7	35
65099:	94	35	86	235	24	7	35	175	249	221	54	19	0	245
65113:	229	253	203	2	134	205	77	13	253	203	2	198	225	241
65127:	237	75	166	249	221	54	18	1	245	197	229	221	113	17
65141:	205	170	34	221	253	58	70	46	5	245	215	229	205	219
65155:	11	225	209	241	71	79	167	126	235	225	40	2	7	16
65169:	252	203	6	23	4	12	8	58	168	249	184	40	81	223
65183:	92	17	32	36	8	18	237	67	177	249	193	197	14	0
65197:	225	205	170	34	221	205	18	70	40	7	217	229	205	217
65211:	11	225	209	126	8	235	237	75	177	249	24	25	62	7
65225:	161	32	20	8	16	19	26	8	221	203	18	70	40	9
65239:	225	213	229	205	219	11	225	209	235	62	7	160	32	7
65253:	221	203	4	70	40	1	35	8	24	165	221	54	18	0
65267:	221	203	4	70	40	12	129	237	68	230	7	40	5	71
65281:	203	6	16	252	35	121	237	68	230	7	40	7	71	8
65295:	7	16	252	24	1	8	18	195	5	62	255	184	32	2
65309:	6	175	52	7	120	254	7	32	4	221	54	18	1	241
65323:	61	194	111	254	195	12	252	205	213	85	56	2	32	1
65337:	201*	225*	195*	166*	250*	205*	213*	45*	56*	247*	32*	245*	167*	40*
65351:	242*	241*	205*	161*	41*	56*	236*	32*	254*	120*	177*	40*	230*	201*

Checksum = 177505

Listing 6. Demonstration program.

```
   1 POKE PEEK 23613+256*PEEK 23614,206: POKE 1+PEEK 23613+256*PEEK 23614,PEEK 23735-6
  50 CLS : PRINT "EXTENDED BASIC  Robert Newman."
  60 REM *****  demo  *********
  65 BORDER 1:*scr 4,0
  70 PRINT "This program shows how the new  commands of the extended BASIC can be used."
  80 PRINT "There are two new sound commands"
  90 GO SUB 8000
 100 PRINT '"  *zap   gives this sound."
 110 FOR j=1 TO 5:*zap: PAUSE 25: NEXT j
 120 PAUSE 50
 130 PRINT '"You can also make white noise   for explosions or gunshots etc. with the command -"
 140 PRINT 'TAB 10;'"*nse n"''
 150 PRINT '"where n is a number from 1 - 255ts set the length of the sound "
 160 FOR j=1 TO 20:*nse 50: NEXT j
 170 GO SUB 9000
 180 PRINT "There is a command for disablingor enabling the BREAK key."
 190 PRINT '"*brk 0   disables BREAK."
 200 PRINT '"*brk 1   re-enables it."
 210*brk 0
 220 PRINT '"Try pressing BREAK while the    counter is running up to 1000..."
 230 FOR j=1 TO 1000
 240 PRINT AT 12,15;j
 250 NEXT j
 260*zap: PRINT AT 15,0;"BREAK is now re-enabled."
 270*brk 1
 280 GO SUB 9000
 300 PRINT "There are several new graphics  commands."
 310 PRINT 'TAB 7;"*scr (paper),(ink)"
 320 PRINT '"will change the paper and ink   colours of the whole screen"
 330 PRINT "without erasing the contents."
 340 PRINT '"Paper and ink colours can take  values from 0 to 9 as with the normal commands."
 350 PRINT AT 16,2;"PRESS A KEY to change colour"
 360 FOR j=0 TO 6
 370 PAUSE 0
 380*scr j,9
 390 NEXT j
 392 PRINT AT 16,0;"
 395 FOR w=1 TO 200: NEXT w
 400 GO SUB 9000
 410 PRINT "The remaining commands allow youto print graphics at any place on the screen."
 420 PRINT "You can use up to 255 graphics  characters, and these can be as large as you wish - even up to  256 x 176 pixels."
 430 PRINT "First you must decide how many  characters you need, and how much memory is required to store"
 440 PRINT "them.  The command :-"
 450 PRINT 'TAB 5;"*use (nchars),(memory)"
 460 PRINT '"where nchars= no. of characters,memory = store size in bytes,"
 470 PRINT "will then allocate space by    lowering RAMTOP (if neccessary)."
 480 PRINT "If you omit this command,"
 490 PRINT "  *use 0,256     is assumed."
 500 GO SUB 9000
 540 PRINT "After allocating graphics space with *use, you can set the size of each character by :"
 550 PRINT 'TAB 4;"*def (char),(width),(ht)"
 560 PRINT '"char  = character number"
 570 PRINT "width = 1 to 256 pixels"
 580 PRINT "ht    = 1 to 176 pixels"
 590 PRINT '"You cannot change the size of a character once defined."
 600 GO SUB 9000
 610 PRINT "The *get command then gets data for the graphic character from off the screen, and it can then be reprinted anywhere using *put"
 620 PRINT '"  *get (char),(xpos),(ypos)"
 630 PRINT '"  *put (char),(xpos),(ypos)"
 640 PRINT '"xpos and ypos are the x and y   pixel coordinates at the top left of a box on the screen from"
 650 PRINT "where the graphic is to be ""got"""
 660 PRINT "or ""put"""
 670 PRINT AT 15,0;"Press key to demonstrate  *put "
 671*use 1,256
 672*def 1,255,8:*get 1,0,55
 680 PAUSE 0
 681 PRINT "The above line has been *got as a 256x8 pixel graphic character and it can now be moved across  the screen one pixel at a time."
 682 PRINT "NB. *put prints with wrap-over."
 683 PAPER 1: INK 7
 690 FOR j=1 TO 255:*put 1,j,55: NEXT j
 692 FOR j=255 TO 1 STEP -1:*put 1,j,55: NEXT
 715*zap:*scr 1,7
 770 GO SUB 9000
 780 PRINT "  *clr (char),(xpos),(ypos)"
 790 PRINT '"will erase a character at the   specified position, or it can beused to clear part of the screen"
 800 PRINT ''''"That is the last of the new      commands. The complete list is:-"
 810 PRINT '"*zap"'"*nse (length)"'"*brk 0/1"'"*scr (paper),(ink)"'"*use (nchars),(memory)"'"*def (char),(width),(ht)"
 820 PRINT "*get (char),(xpos),(ypos)"'"*put (char),(xpos),(ypos)"'"*clr (char),(xpos),(ypos)"
 830 GO SUB 9000
 840 PRINT "Finally, a short demo using the extended BASIC commands to move graphics around the screen."
 850 PRINT "First, *get is used to copy the graphic characters :-"
 855 REM the characters in the next line are user graphics
 860 PRINT '" FG  JK  AB  CDE"'" HI  LM"
 870*use 5,200:*def 1,22,15:*def 2,22,15:*def 3,22,8:*def 4,15,8:*def 5,4,11
 880*get 1,8,127:*get 2,35,127:*get 3,68,127:*get 4,101,127:*get 5,132,127
 890 DIM x(5): DIM a(5)
 900 FOR j=1 TO 5
 910 LET x(j)=0
 920 LET a(j)=INT (1+RND*4)
 930 NEXT j
 940 GO SUB 9000
 950 CLS :*scr 4,0
 955 PRINT TAB 3;"Place your bets now !!"
 960 FOR j=1 TO 53
 970 FOR k=1 TO 5
 980*put 1,x(k),k*25
 990 NEXT k
1000 FOR k=1 TO 5:*put 2,x(k),k*25
1010 LET x(k)=x(k)+a(k)
1020 NEXT k
1030 NEXT j
1040*zap: CLS :*scr 0,2
1050 FOR j=1 TO 2
1060 FOR k=0 TO 237 STEP 3
1070*put 3,k,150: NEXT k
1080 FOR k=237 TO 0 STEP -3
1090*put 3,k,150: NEXT k
1100 NEXT j
1110*put 4,150,101*zap:*nse 40
1120 FOR j=0 TO 24
1130*put 3,j*6,150:*put 5,154,30+5*j
1140*put 3,j*6+3,150
1150 NEXT j
1160*nse 150:*clr 3,147,150
1170 STOP
8000 RESTORE 8050
8010 FOR j=0 TO 103
8020 READ n
8030 POKE USR "a"+j,n
8040 NEXT j
8050 DATA 192,64,19,60,84,247,92,8,12,16,32,240,168,188,252,64
8060 DATA 1,1,7,15,31,63,248,240,0,0,192,224,240,248,62,30
8070 DATA 2,1,2,4,2,1,0,0
8080 DATA 0,0,0,0,195,33,31,30,0,0,192,128,120,94,123,79
8090 DATA 31,60,48,96,64,128,128,0,248,104,24,6,4,4,1,6
8100 DATA 0,0,1,3,65,175,31,31,64,224,120,172,252,127,84,188
8110 DATA 31,32,4,4,2,2,1,0,24,8,16,16,32,32,64,0
8120 RETURN
9000 PRINT AT 21,3;"PRESS A KEY FOR NEXT PAGE."
9010 IF INKEY$="" THEN  GO TO 9010
9020 CLS : RETURN
```

(continued from previous page)

The *Get command will copy a character from the specified position on the screen, and store it in the graphics memory. It can then be printed anywhere on the screen using *Put. If the values of (Xpos) and (Ypos) cause part of the character to go over the edge, then it will wrap-around to the opposite side of the screen. The *Clr command can be used to erase a character, or alternatively it can be used to clear a window on the screen.

For example, the instructions

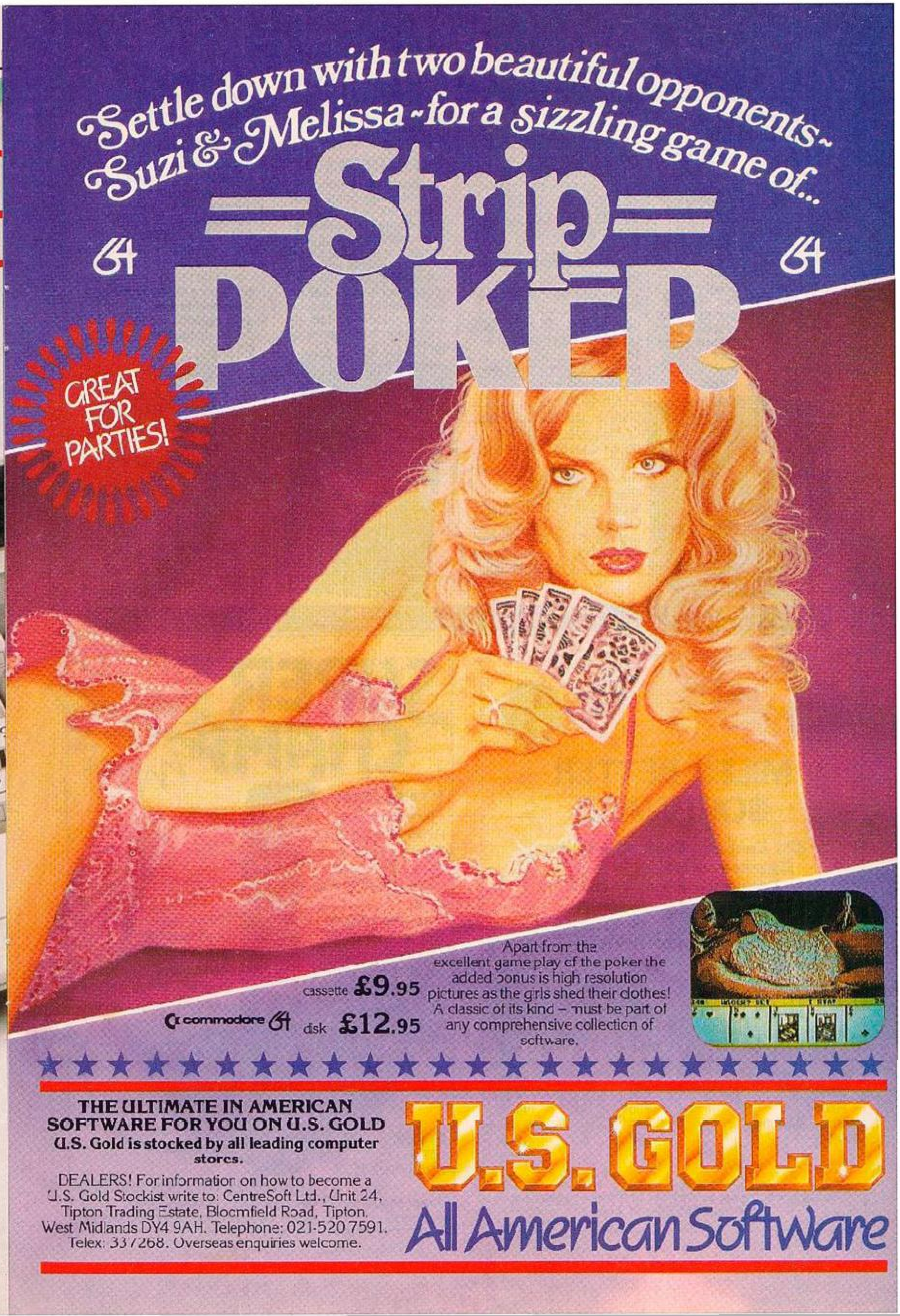
*DEF 1,16,16 : *GET 1,0,175 : *PUT 1,240,15

would copy an area of the screen 16 by 16 pixels in size from the top left of the screen to the bottom right.

If you would like a cassette tape of the machine code and demonstration programs, please send £3 to 47, Wellingborough Road, Broughton, Kettering, Northants, NN14 1PD. ■

Listing 7. Demonstration program

```
   1 POKE PEEK 23613+256*PEEK 23614,206: POKE 1+PEEK 23613+256*PEEK 23614,PEEK 23735-6
  10 CLS : BORDER 2:*scr 5,0
  20 DIM s(16): DIM n(16,4)
  30 DEF FN [illegible]
  40 DEF FN [illegible]
  50 DEF FN x(n)=1+43*(FN [illegible])-1
  60 DEF FN y(n)=174-40*FN [illegible]
 130 PRINT "
 140 PRINT "  ABCD
 ...
 200 PRINT "  EFGH
 ...
 240 PRINT "  IJKL
 ...
 290 PRINT "  MNO
 ...
 320 PRINT "
 330 GO SUB 7000
 340*use 15,2880
 350 FOR j=1 TO 15:*def j,38,38:*get j,FN x(j),FN y(j): NEXT j
 360 GO SUB 9000
1000*scr 6,0
1010 PRINT AT 21,3; FLASH 1;"SHUFFLING"
1015 RANDOMIZE 0
1020 FOR j=1 TO 15: LET s(j)=j: NEXT j
1025 LET s(16)=0: LET e=16
1030 FOR j=1 TO 332
1040 LET t=[illegible]: IF n(e,t)=0 THEN  GO TO 1040
1050 LET s(e)=s(n(e,t))
1060 LET s(n(e,t))=0
1070 LET e=n(e,t)
1080 NEXT j
1100 POKE 23658,8: CLS :*scr 4,0: BORDER 4
1110 PRINT TAB 21;"Use cursor";TAB 21;"keys to put";TAB 21;"pieces back"
1120 PRINT TAB 21;"in correct";TAB 21;"position :-"
1130 PRINT TAB 23;"ABCD";TAB 23;"EFGH";TAB 23;"IJKL";TAB 23;"MNO"
1140 PRINT  TAB 21;"Key A to";TAB 2[illegible];"start game."
1150 PRINT AT 16,2[illegible];"MOVES TAKEN";TAB 24;0
1160 LET m=0
1170 FOR j=1 TO 16
1190 IF s(j)<>0 THEN *put s(j),FN x(j),FN y(j)
1200 NEXT j
1210 GO SUB 7000
2000 LET a$=INKEY$: IF a$="" THEN  GO TO 2000
2010 IF a$="A" THEN  GO TO 3000
2020 LET d=CODE a$-52: IF d<1 OR d>4 THEN  GO TO 2000
2030 IF n(e,d)=0 THEN  GO TO 2000
2040 LET c=s(n(e,d))
2050 LET x1=FN x(n(e,d)): LET y1=FN y(n(e,d))
2060 LET x2=FN x(e): LET y2=FN y(e)
2070 GO SUB 4900+100*d
2080 GO SUB 7000
2090 LET s(e)=c
2100 LET s(n(e,d))=0
2110 LET e=n(e,d)
2120 LET m=m+1: PRINT AT 16,24;m
2130 IF e<>16 THEN  GO TO 2000
2140 LET i=1
2150 IF s(i)<>i THEN  GO TO 2000
2160 IF i=15 THEN  GO TO 2500
2170 LET i=i+1: GO TO 2150
2500 PRINT AT 10,22; FLASH 1;"WELL DONE"
2500 INPUT "Another game (Y/N)? ";a$
2510 IF a$="Y" THEN  GO TO 1000
2520 STOP
3000 INPUT "Give up (Y/N)? ";a$
3010 IF a$="Y" THEN  GO TO 2600
3020 GO TO 2000
5000 FOR j=x1 TO x2 STEP -2:*put c,j,y1: NEXT j: RETURN
5100 FOR j=y1 TO y2 STEP -2:*put c,x1,j: NEXT j: RETURN
5200 FOR j=y1 TO y2 STEP 2:*put c,x1,j: NEXT j: RETURN
5300 FOR j=x1 TO x2 STEP 2:*put c,j,y1: NEXT j: RETURN
7000 FOR j=0 TO 4: PLOT j*40,175: DRAW 0,-160: NEXT j
7010 FOR j=15 TO 175 STEP 40: PLOT 0,j: DRAW 160,0: NEXT j
7020 RETURN
9000 RESTORE 9050
9010 FOR j=1 TO 16
9020 FOR k=1 TO 4: READ n(j,k): NEXT k
9030 NEXT j
9040 RETURN
9050 DATA [illegible]
9060 DATA [illegible]
```



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RESPONSE FRAME

Do you have a problem? Your manual is incomprehensible or you just cannot get the hang of that programming trick you tried — whatever it is, Tim Hartnell will do his best to answer your queries. Please include only one question per letter and mark them "Response Frame".

QL TIMING

I have finally, after months and months and months of waiting, got my QL. I am writing a game in which the time it takes a player to enter a move is crucial — there is a limited number of seconds to enter the answer. I thought the inbuilt clock would be ideal for this. However, I can't get it to work as it claims it does in the manual, and to extract parts of the Date$ — although the manual suggests this is the same as extracting 'slices' of any string — seems impossible. How can I do it?

Ian Cavalier, Huntingdon.

I HAVE ALSO HAD some problems working out how to use the clock. I suggest you define two procedures: The first one, which you could call something like Setclock, would just reset the clock to zero after each move, with the line

SDATE 1984,9,3,0,0,0

or you could just include this within the program, if you didn't want to set up a separate procedure.

The second one, to print just the part of the time you want on the screen, could be called Printclock. It would need to include

C_OCKS = DATE$: PRINT CLOCK$ (15 TO 20)

to get minutes and seconds, or

CLOCK$(19 TO 20)

just to get the seconds. The last two characters of Clock$ can also be checked for their numeric value if you want the program to do something after a specific time has elapsed.

THREE AND ONE

On reading that some Issue Three ZX Spectrum owners are experiencing difficulty loading commercial software, I am writing to inquire where you've heard of Issue One owners having problems loading some of the latest software releases. Quicksilva's Ant Attack just will not load on my Specrum, and yet it will run on my friend's Issue Three machine. Could it be that software writers have now mastered the Issue Three problems at the expense of Issue One owners, or could it be that my trusted Issue One is feeling its age?

Brian Richardson, Sittingbourne, Kent.

THERE SHOULD BE no problems with Ant Attack as I have seen it running quite happily on an Issue One machine. However, I have been told that there is some current software which "hiccups" a little on Issue One's. I suggest you go back to the store where you bought Ant Attack, tell them it won't load, and get another copy. If that doesn't work, perhaps your machine is feeling its age and either an overhaul is called for, or you'll have to settle for some other program.

BBC SUBSTITUTE

I used to own a 48K Spectrum, and was very happy with it. I especially like the Screen$ and ATTR commands. Now I have a BBC Model B. To my surprise — and disappointment — I have found that this computer does not use those commands, so I feel very restricted in what I can do. Is there any way I can substitute these commands on my BBC Micro?

Nauman Butt, Dean Park, Renfrew.

YOU CAN USE the Point command to return the colour of a single pixel. This does not work in Mode 7. Alternatively, and far more satisfactorily, you could investigate the operating system call which provides the functions you want. It is explained on page 432 of the user guide, where there is a program of 110 lines or so to demonstrate how it is done.

ACE IN THE HAND?

I am interested in learning Forth and have noticed that the Jupiter Ace is now available from some sources for as low as £29.95. However, I am reluctant to buy a machine from a company which is out of business and for which there is no expandability and little software. Can one get a colour board and, if so, is it possible to generate a true hi-res display?

C J Slade, Rochester, Kent.

IT SEEMS IT WOULD be hard to go wrong with a £29.95 machine, although the Ace is becoming increasingly difficult to get hold of. An add-on memory is the only peripheral which I have seen widely advertised. It might well be a better buy to get a Spectrum, and then buy one of the available Forth programs such as that produced by Artic, than start going down a dead-end street.

WHAT ADD-ONS?

I have a BBC Model B, and am very pleased with it. However, now that I've been using it for a year — and have saved up some more money — I would like to expand the hardware. I would appreciate it if you could give me some ideas of the priorities I should assign to various bits of add-on hardware, so I would know which ones to buy first.

Martin Kersh, Southsea.

THIS QUESTION IS, I'm afraid, almost impossible to answer as you do not indicate the prime use of your BBC Micro, nor do you tell me what hardware you already have. However, keeping in mind that your letter suggests you have a "basic" Model B, and that your activities with the computer presumably include playing commercial software and writing your own programs, I would suggest the following should be considered first.

A disc drive is a tremendous asset to have, and you'll soon wonder why you put up with cassettes for so long. A wide range of drives is available, from around £160 for 5¼ inch 40 track, single-sided drives, dual drives of a similar standard are around £340, and a double-sided 3 inch Microdrive — which is totally compatible with 5¼ inch drives — is available from around £230.

A joystick will add a lot to your game playing, and these start from around £10. If writing your own programs is a higher priority than running commercial games, you might consider adding the Second Processor. Full details on this are available from Acorn Computers Ltd., Fulbourn Road, Cherry Hinton, Cambridge, CB1 4JN.

EASY REMS

In an earlier issue of *Your Computer*, there was a game called Frogger, which required one long Rem statement of 6208 characters. Please could you tell me an easy and reliable way to do this, as I have not yet fully mastered machine code on my ZX-81?

R G Simmons, Studley, Warwickshire.

THERE ARE MANY ways of solving the problem. A particularly elegant way — developed by the former chairman of the Dutch ZX Users Group, Han van Abbe of Wassenaar, and passed on to me by Jan Verhoeven — suggests Peking the machine code into a Print statement. The procedure is as follows. Type in a Print statement with the structure

PRINT 0 - 0 + 0 + 0 + 0 + . . . etc.

Every combination of a zero and a plus sign takes up one byte for the character zero, one byte for the delimiter (126), five bytes for the floating point representation, and one byte for the plus sign. Altogether this yields eight bytes of memory space, with only two bytes of screen space. You next enter the line,

POKE 16513,234

to change the Print token to Rem, and then use your hex loader to fill the Rem.

Another method, devised by Jan Verhoeven himself, uses a single large Rem statement which takes up about 200 spaces. This line is repeatedly editted, and during every edit the line number is changed. You first type in the large Rem statement, and use Edit to alter the line number several times. Next you enter the statement

LET L = PEEK 16511 + 256 * PEEK 16512

to get L as the length of one line. Add 4 to L, and add the new L to the old L. Poke a Newline (118) in locations 15514 and 16515 to prevent the display from uncontrolled scrolling during listings. Repeat these steps until enough space is reserved. But, take care, as a mistake is easily made.

COPYRIGHT

We are setting up a software business, and are wondering what to do about copyright. Also, what tape do you suggest we use for sound and speech?

Simon Martin and Craig Stagey, Lynsted, Kent.

THE PROBLEM OF copyright is a difficult one. At the moment, despite the best efforts of the Guild of Software Houses, it seems impossible to stop people copying your tapes if they want to, although a few ingenious systems — such as providing a hard-to-photocopy colour code card which tells you which numbers to enter at the beginning of a load — have been tried.

As to sound and speech, I'm afraid you'll have to develop your own routines, if you are to include them with your programs.

In this column a few months ago, I said in response to a reader's question, that I had had difficulty including Verify within a Spectrum program. Many readers contacted me to point out that it is, in fact, very easy to do. Among those who took the trouble to point this out was Ian Hoare, author of the Bugbyte program Computer Cookbook. He says he uses a standard Verify line at the end of each of his programs — which is still there on the commercially-available cassettes of his work. The line is as follows:

9999 CLS: SAVE "name of program" LINE 0 : SAVE "name" CODE 55120,415: VERIFY "name of program": PRINT "PROGRAM OK": VERIFY "name" CODE: PRINT "CODE OK"



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SOFTWARE FILE

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Rhythmix

*Timothy Closs,
Shepperton,
Middlesex.*

SPECTRUM

RHYTHMIX ENABLES you to record digitally up to six separate sounds which may then be replayed manually on the computer keyboard. Alternatively, they can be programmed into a fixed sequence to give rhythmic accompaniment while you play another musical instrument. As a visual extra, the screen border can be made to flash in time with the rhythm.

When you run the program, a menu will be displayed:

1. RECORD
2. PLAY
3. PROGRAM
4. RUN
5. BORDER FLASH

RECORD sets up your cassette player as in figure 1 and type in a number from 1 to 6. Generate your first sound near the microphone — it will be stored by the computer, to be recalled under Play or Run below. Now type in your second number, generate your second sound, and so on up to a maximum of six. It is worth experimenting with a wide variety of sounds — including the human voice — as the results can be quite surprising, but the duration of each should not exceed about 0.5 seconds.

PLAY: By tapping the keys 1 to 6 you can now reproduce sounds from your rhythm bank to accompany other musicians. Amplification is achieved through the set-up in figure 2. Pressing E at any stage will Escape to the menu.

PROGRAM: First enter the number of beats you want in your rhythm sequence — anything from 1 to about 60 might be suitable. Then tap out the sounds using keys 1 to 6 as above. The sounds will be heard as you program them in. Typing R records a rest i.e., a period of silence equal in length to each of the sounds. An audible bleep confirms that the rest has been entered.

RUN: The computer will ask you for the required speed. Returning 1 gives the fastest rate of replay, while higher numbers give successively slower and lower frequency rhythms. Your programmed rhythm will now be repeated over and over until the menu is called by pressing E.

BORDER FLASH: Using the normal border colour numbers — for example 2 is red — enter first the colour for sound on and then the colour for sound off.

```
  6 POKE 23658,8: GO SUB 6000:
GO TO 500
 100 REM ******RHYTHMIX*******
 110 REM ****BY TIM CLOSS****
 120 REM ********************
 500 CLS : POKE 32050,1: PRINT "
*****RHYTHMIX*****MAIN MENU*****
": PRINT : PRINT "(1)-RECORD": P
RINT : PRINT "(2)-PLAY": PRINT :
 PRINT "(3)-PROGRAM": PRINT : PR
INT "(4)-RUN": PRINT : PRINT "(5
)-BORDER FLASH"
 501 IF INKEY$="4" THEN GO TO 40
00
 502 IF INKEY$="5" THEN GO TO 50
00
 505 IF INKEY$="1" THEN GO TO 51
3
 506 IF INKEY$="2" THEN GO TO 20
00
 507 IF INKEY$="3" THEN GO TO 30
00
 512 GO TO 501
 513 INPUT "SOUND NO. ? ";S: LET
 S=S-1
 514 POKE 32002,128+(S*20)
 515 PRINT AT 15,10;"ENTER SOUND
 NOW"
```

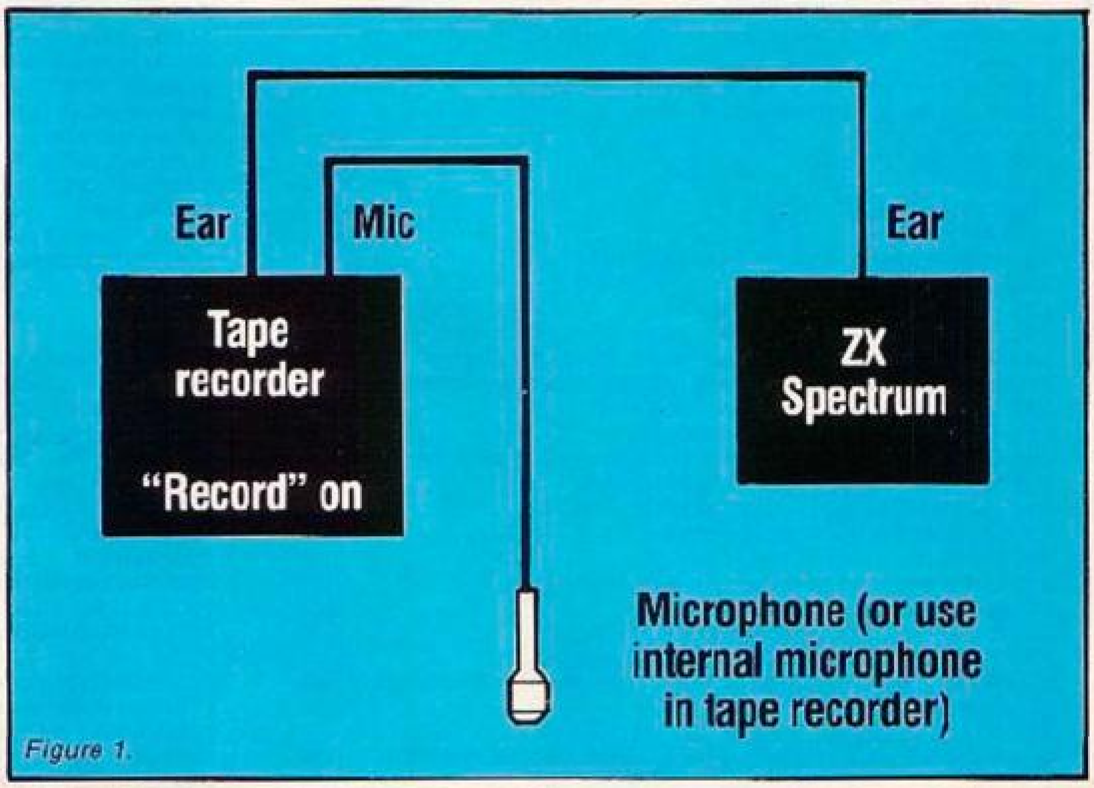


Figure 1.

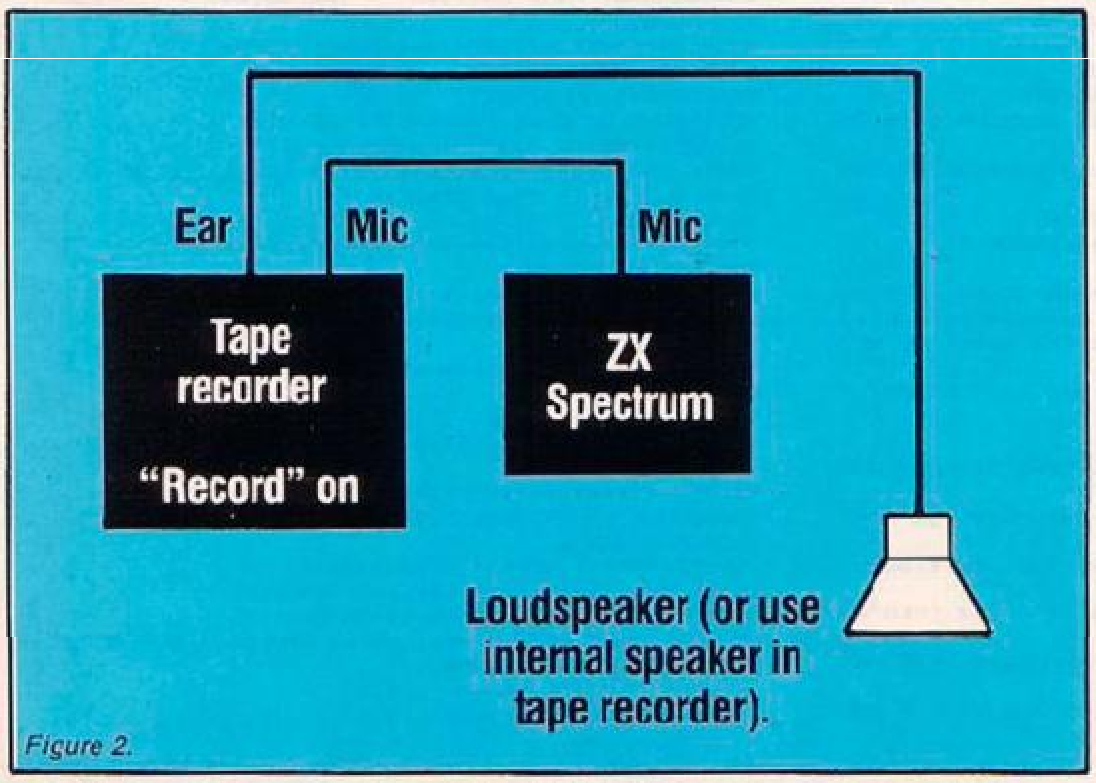


Figure 2.

```
 520 IF IN 61438=255 THEN GO TO
520
 530 LET A=USR 32000
 535 PRINT AT 15,10;"SOUND RECEI
VED      "
 540 PAUSE 0
 550 GO TO 500
2000 LET E$=INKEY$
2005 IF E$="E" THEN GO TO 500
2010 IF E$="1" THEN POKE 32032,1
28: LET A=USR 32030: GO TO 2000
2011 IF E$="2" THEN POKE 32032,1
48: LET A=USR 32030: GO TO 2000
2012 IF E$="3" THEN POKE 32032,1
68: LET A=USR 32030: GO TO 2000
2013 IF E$="4" THEN POKE 32032,1
88: LET A=USR 32030: GO TO 2000
2014 IF E$="5" THEN POKE 32032,2
08: LET A=USR 32030: GO TO 2000
2015 IF E$="6" THEN POKE 32032,2
28: LET A=USR 32030
2030 GO TO 2000
3000 INPUT "BEATS ? ";B
3010 DIM G(B)
3020 FOR H=1 TO B
3021 IF INKEY$="R" THEN BEEP .2,
10: LET G(H)=10: GO TO 3025
```

(continued on next page)

(continued from previous page)

```
3022 IF CODE INKEY$<49 OR CODE I
NKEY$>57 THEN GO TO 3021
3023 LET G(H)=(CODE INKEY$)-49
3024 POKE 32032,128+(20*G(H)): L
ET A=USR 32030
3025 NEXT H
3030 GO TO 500
4000 INPUT "SPEED ? ";S: POKE 32
050,S
4005 FOR H=1 TO 8
4006 IF G(H)=10 THEN FOR D=1 TO
26+(PEEK 32050): NEXT D: GO TO 4
015
4010 POKE 32032,128+(20*G(H)): L
ET A=USR 32030
4015 IF INKEY$="E" THEN GO TO 50
0
4020 NEXT H
4030 GO TO 4005
5000 INPUT "OFF COLOUR ? ";O: IN
PUT "ON COLOUR ";N
5010 IF O<0 OR O>7 OR N<0 OR N>7
 THEN GO TO 5000
5020 POKE 32044,O
5030 POKE 32061,16+N
5040 GO TO 500
6000 FOR G=32000 TO 32065
6010 READ D: POKE G,D: NEXT G
6020 RESTORE : RETURN
6030 DATA 33,0,128,6,20,197,6,0,
62,254,219,254,119,197,6,1,16,-2
,193,35,16,-14,193,16,-20,201,0,
0,0,0,33,0,128,6,20,197,6,0,62,1
91,190,40,17,62,7,211,254,35,197
,6,1,16,-2,193,16,-18,193,16,-24
,201,62,16,211,254,24,-19
```

Back beat

David Quinney,
Solihull,
West Midlands.

BBC

THIS PROGRAM, WITH a bit of skill, will produce a reasonable backing beat. A lot of the program could be cut down in length, but in its present state it is much easier to read and thus debug after entering.

The program is written in Mode 1 due to the size of the screen and has 16 steps each which will produce four different beats simultaneously. The 16 steps can be decreased by altering the two stars at the edge of the screen. The main instructions are included in the program.

Program breakdown.

Lines	
110- 230	Main loop for entering beat
240- 490	Instructions
500- 580	Set up variables
590- 810	Draw screen
820- 980	Move cursor, update screen
990-1130	Play beat pattern
1140-1200	Speed
1210-1230	Move step pointer
1240-1410	Save beat pattern
1420-1580	Load beat pattern
1590-1660	Draws pattern after saving or loading
1670-1730	Clear beat pattern
1740-1750	Error routine

Variables.

A%,B% – co-ordinate of cursor
O% – step pointer
L% – speed
M%(3,15) – array for beat pattern

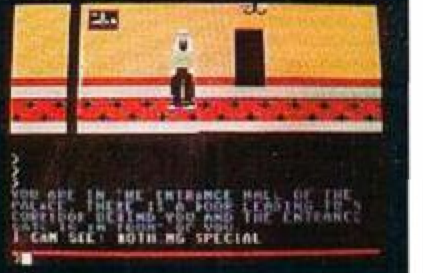
All £ should be read as #

```
10REM (C) D.A.QUINNEY 1984
20REM     BEAT MACHINE
30REM     ____________
40REM For all    in listing type  £
50*KEY100_D:MGOTO1660:M
60MODE7
70PROCINST
80MODE1
90PROCSETUP
100PROCSCREEN
110PRINTTAB(A%,B%)">"TAB(A%+2,B%)"<"
120*FX21,0
130 IF INKEY(-42)=-1 AND B%<23 C%=1:PROCMOVE
140 IF INKEY(-58)=-1 AND B%>8 C%=2:PROCMOVE
150 IF INKEY(-26)=-1 AND A%>9 C%=3:PROCMOVE
160 IF INKEY(-122)=-1 AND A%<33 C%=4:PROCMOVE
170 IF INKEY(-67)=-1 PROCBEAT
180 IF INKEY(-104)=-1 PROCEBEAT
190 IF INKEY(-73)=-1 AND O%<>(B%-8) PROCSTAR
200 IF INKEY(-82)=-1 CLS:PROCSAVE
210 IF INKEY(-87)=-1 CLS:PROCLOAD
220IF INKEY(-56)=-1 GOTO990
230GOTO110
240REM******************************
250DEFPROCINST
260PRINTTAB(13)CHR$129"BEAT MACHINE"
270PRINTTAB(13)CHR$129"____ _______"
280PRINT''"Do you want instructions ?":G$=GET$:IF G$
="N" ENDPROC
290VDU28,0,23,39,2:CLS
300PRINT"These controls are used in"CHR$129"EDIT MOD
E :-"
310PRINT'CHR$129" 'X' "CHR$135"   Make beat."
320PRINTCHR$129" '.' "CHR$135"  -To clear."
330 PRINTCHR$129" 'S' "CHR$135"  -SAVE DATA."
340PRINTCHR$129" 'L' "CHR$135"  -LOAD DATA."
350PRINT'CHR$129" 'P' "CHR$135"  -Put machine into"CH
R$131"PLAY MODE."
360PRINT'CHR$131" '*' "CHR$135"  -Move"CHR$131"pointe
r"CHR$135"to CURSOR position"
370PRINTCHR$129"'> <' "CHR$135" -CURSOR."
380PRINTCHR$129"CURSOR Keys to move CURSOR."
390PRINT'CHR$131"POINTER."
400PRINT" On either side of the screen there is a po
inter.Where ever the pointer is the  machine will play
 to this position and  then return to the start of you
r beat   pattern."
410PRINTTAB(6)CHR$136CHR$133"PRESS ANY KEY TO CONTIN
UE."
420G$=GET$:CLS
430PRINT"These controls are used in"CHR$131"PLAY MOD
E :-"
440PRINT'CHR$131"'>'";CHR$135;"   -Make beat go fast
er."
450PRINTCHR$131"'<'"CHR$135"   -Make beat go slower.
"
460PRINT'CHR$129"ESCAPE"CHR$135"-Put machine into"CH
R$129"EDIT MODE."
470PRINT''CHR$129"BREAK will clear unwanted beat pat
tern."
480PRINTTAB(6,20)CHR$136CHR$133"PRESS ANY KEY TO CON
TINUE.":G$=GET$
490ENDPROC
500REM*********************************
510DEFPROCSETUP
520ON ERROR GOTO1750
530VDU23;8202;0;0;0;
540DIM M%(3,15)
550O%=15:L%=1000:A%=9:B%=8
560ENVELOPE1,2,0,0,0,0,0,0,126, 60, 60,0,126,60
570ENVELOPE2,1,0,0,0,0,0,0,126,-10,0,-1,126,100
580ENDPROC
590REM*********************************
600DEFPROCSCREEN
610@%=&5
620CLS
630COLOUR1
640PRINTTAB(13)"BEAT MACHINE"
650PRINTTAB(13)"---- -------"
660COLOUR3
670PRINT'Type 'X' for beat,'.' to clear,"
680PRINT"'P' to play,'ESCAPE' to stop beat,"
690PRINT"and '*' to return to start of beat."
700PRINT"Finally 'S' to SAVE and 'L' to LOAD"
710COLOUR1
720PRINT'"  Indic. BASS   SNARE   BLEEP  TRIANGLE"
730FORR%=1TO16:PRINTR%:NEXT
740COLOUR3
750FORR%=8TO23:FORE%=10TO34STEP8:PRINTTAB(E%,R%)".":
NEXT,
760PRINTTAB(0,30)"CURSOR KEYS TO MOVE EDITOR"
770PRINTTAB(0,26)"'<'=SLOWER,'>'=FASTER."
780COLOUR1:PRINT'SPEED (0=Fastest)=   14"
790PRINTTAB(15,24)"EDIT MODE"
800COLOUR2:PRINTTAB(0,23)"*"TAB(36,23)"*":COLOUR3
810ENDPROC
820REM*********************************
830DEFPROCMOVE
840FORR%=1TO800:NEXT
850IFC%=3 OR C%=4 FORR%=1TO1000:NEXT
860PRINTTAB(A%,B%)" "TAB(A%+2,B%)" "
870IF C%=1 B%=B%+1 ELSE IF C%=2 B%=B%-1 ELSE IF C%=3
 A%=A%-8 ELSE IF C%=4 A%=A%+8
880ENDPROC
890REM*********************************
900DEFPROCBEAT
910PRINTTAB(A%+1,B%)"X"
920M%((A%-1)/8-1,B%-8)=1
930ENDPROC
940REM*********************************
950DEFPROCEBEAT
960PRINTTAB(A%+1,B%)"."
970M%((A%-1)/8-1,B%-8)=0
980ENDPROC
990REM*************PLAY**************
1000COLOUR2:PRINTTAB(15,24)"PLAY MODE"
1010FORR%=0TOO%
1020PRINTTAB(1,R%+7)" "TAB(1,R%+8)">"
1030IF INKEY(-104)=-1 L%=L%-50:PROCUP
1040IF INKEY(-103)=-1 L%=L%+50:PROCUP
1050IFM%(0,R%)=1 AND M%(1,R%)=1 SOUND0,1,5,2:GOTO1080
1060IFM%(0,R%)=1 SOUND0,1,6,2
1070IFM%(1,R%)=1 SOUND0,1,4,2
1080IFM%(2,R%)=1 SOUND1,-15,97,1
```

(continued on page 155)







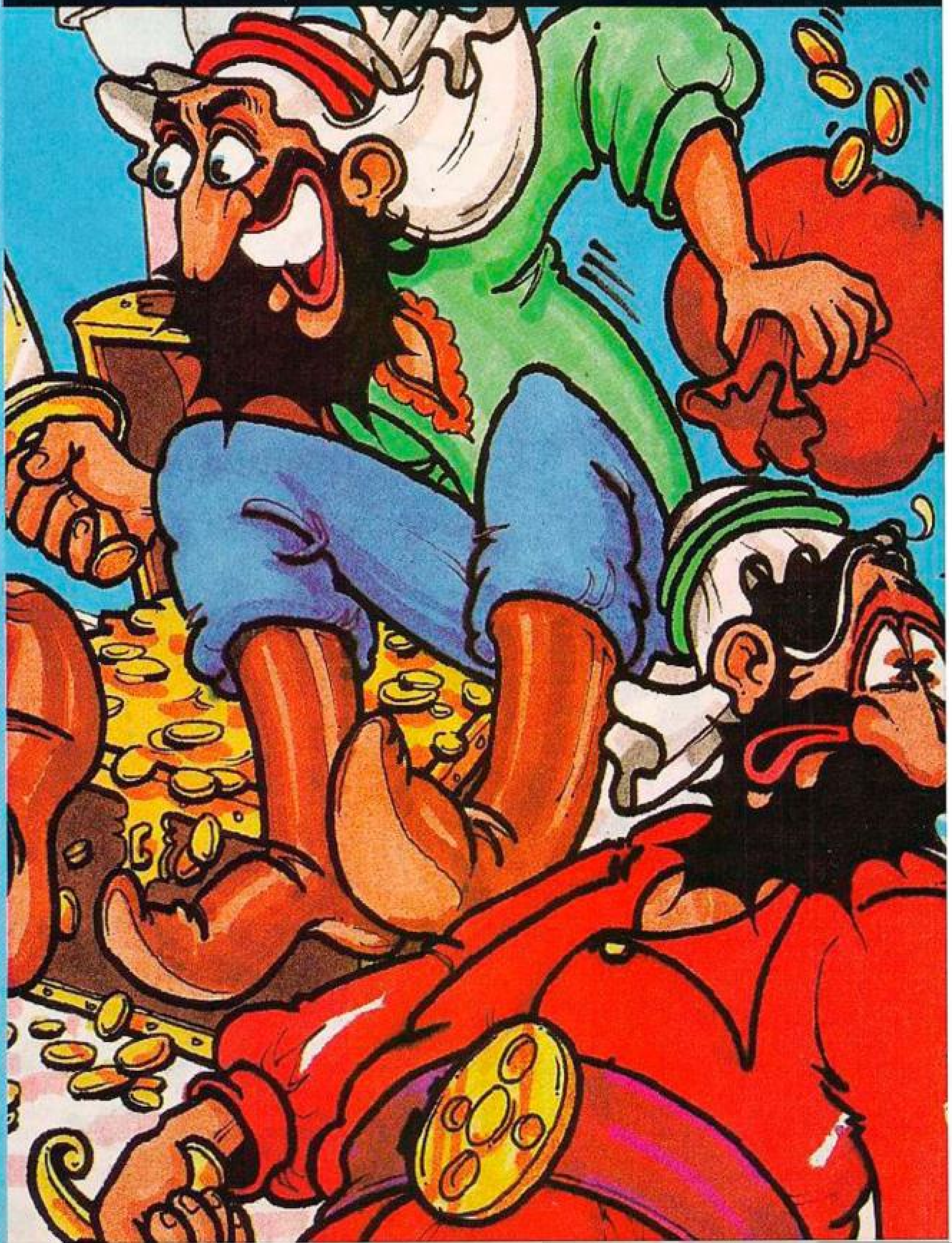
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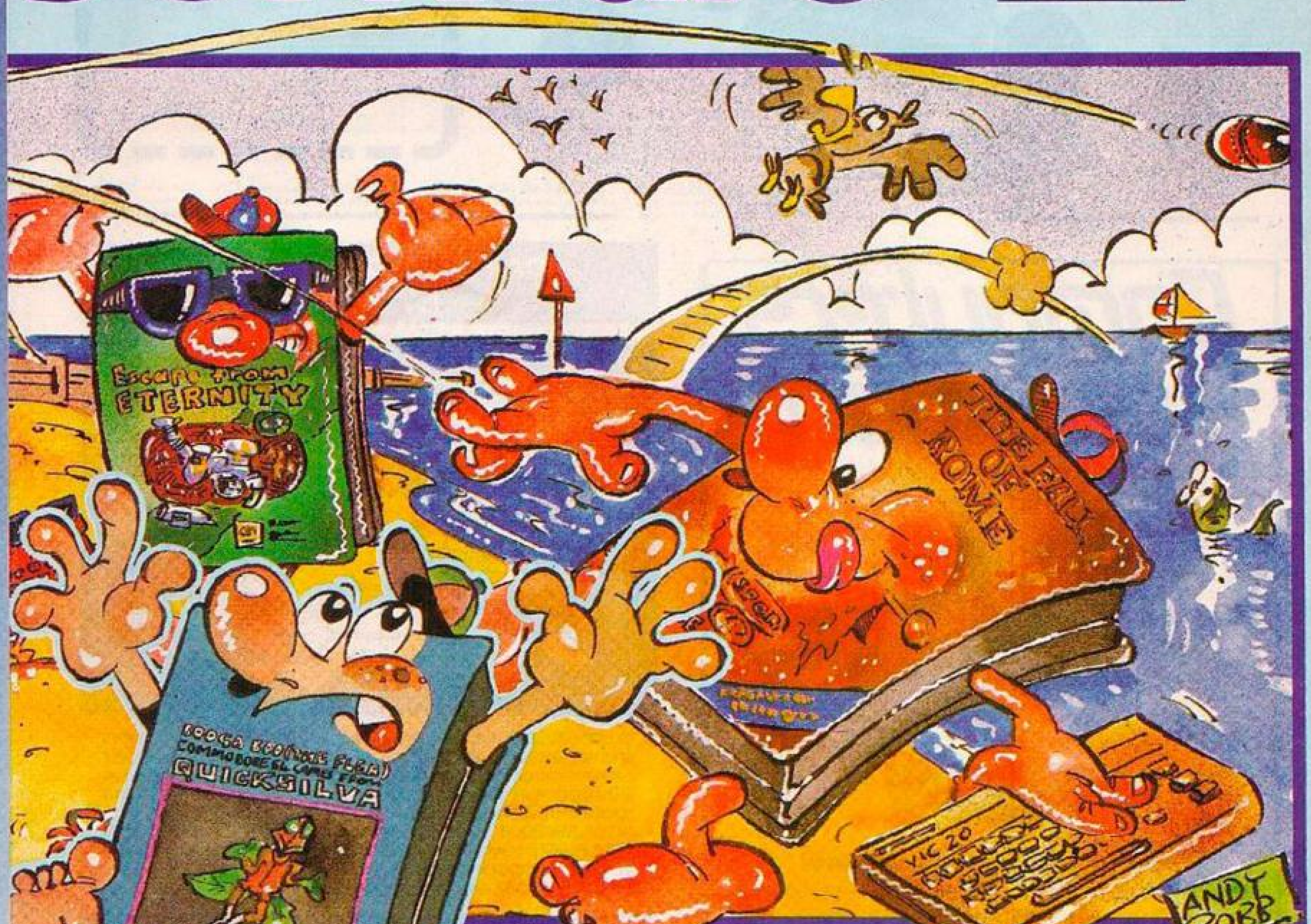
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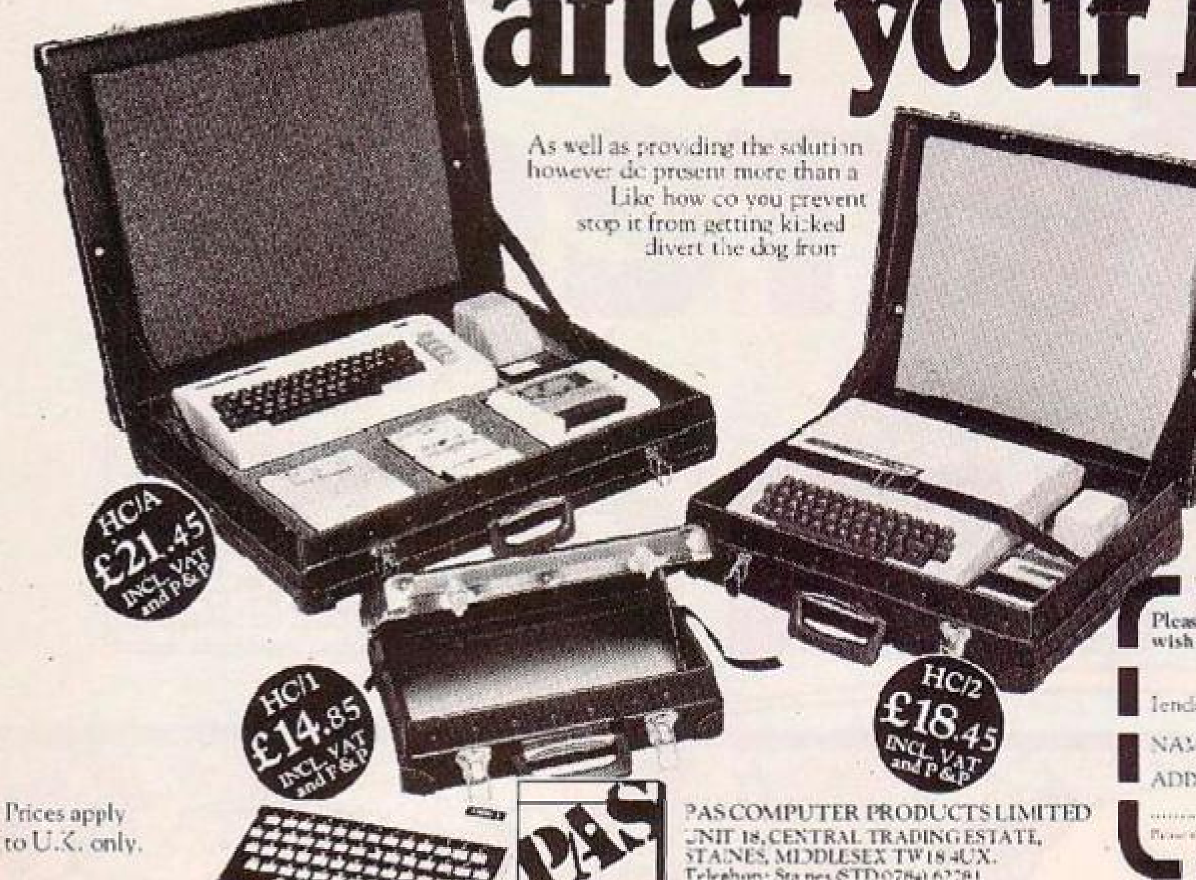


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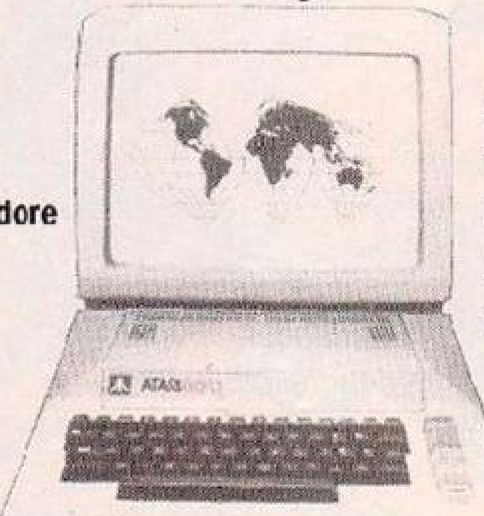
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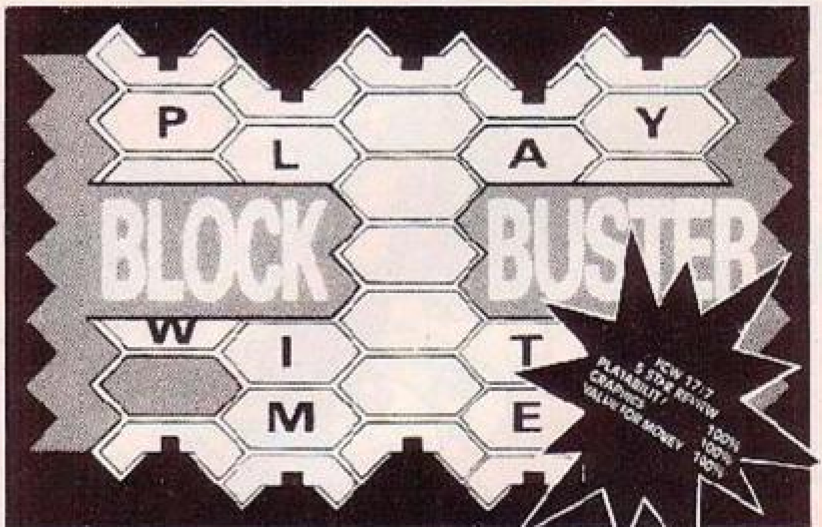
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(continued from page 150)

```
1090IFM%(3,R%)=1 SOUND3,2,245,1
1100FORE%=1TOL%:NEXT
1110NEXT
1120PRINTTAB(1,R%+7)" "
1130GOTO1010
1140REM*******************************
1150DEFPROCUP
1160COLOUR1
1170IFL%<300 L%=300
1180PRINTTAB(18,27)"   "TAB(18,27)(L%/50)-6
1190COLOUR3
1200ENDPROC
1210REM*******************************
1220DEFPROCSTAR
1230PRINTTAB(0,O%+0)" "TAB(36,O%+0)" ":COLOUR2:PRINTT
AB(0,B%)"*"TAB(36,B%)"*":COLOUR3:O%=B%-8:ENDPROC
1240REM*******************************
1250DEFPROCSAVE
1260*FX200,1
1270COLOUR2
1280PRINT'TAB(15)"SAVE MODE'
1290PRINTTAB(14)'-----------"
1300PRINTTAB(5,10)"PLEASE PRESS ';
1310Z%=OPENOUT "BEAT"
1320PRINT'"PLEASE WAIT"
1330 FORE%=0TO3
1340FORR%=0TO15
1350PRINT£Z%,M%(E%,R%)
1360NEXT,
1370CLOSE£Z%
1380VDU7
1390PROCDRAW
1400*FX200,0
1410ENDPROC
1420REM*******************************
1430DEFPROCLOAD
1440*FX200,1
1450COLOUR2
1460PRINT'TAB(15)"LOAD MODE"
1470PRINTTAB(14)"-----------"
1480PRINTTAB(1,10)"Play tape and please wait for DATA
     to load"
1490Z%=OPENIN "BEAT"
1500FORE%=0TO3
1510FORR%=0TO15
1520INPUT£Z%,M%(E%,R%)
1530NEXT,
1540CLOSE£Z%
1550VDU7
1560PROCDRAW
1570*FX200,0
1580ENDPROC
1590REM*******************************
1600DEFPROCDRAW
1610PROCSCREEN
1620FORE%=0TO3
1630FORR%=0TO15
1640IFM%(E%,R%)=1 THEN PRINTTAB(E%*8+10,R%+8)"X'
1650NEXT,
1660ENDPROC
1670REM*******************************
1680MODE1
1690COLOUR1
1700PRINTTAB(15,15)"CLEARED"
1710PRINTTAB(14)"---------"
1720FORR%=1TO5000:NEXT
1730GOTO90
1740REM*******************************
1750 IF ERR=17 PRINTTAB(1,R%+8)' ":COLOUR1:PRINTTAB(1
5,24)"EDIT MODE":COLOUR3:GOTO110 ELSE MODE7:REPORT:PRI
NT" AT LINE ";ERL
```

Boggled

D Harris,
Great Barr,
Birmingham.

ZX-81

BOGGLED IS BASED on a popular table game and although exiting to play, a few problems become apparent after playing the game a few times.

One of the players has to shake the box containing the dice, remove the lid without looking at the dice in position and lastly start the timer. I then decided to program the game on my ZX-81 which would solve all these problems and also enable more than four people to take part with these added benefits:

- No shaking of dice — no noise.
- All players have equal advantage in seeing the playing grid one way up. Normally, four players would sit around a table and the board will appear different in each position. This results in some players finding some words and maybe higher scoring words, easier.
- The screen goes blank to end the game when the timer is finished. This stops the players writing on after time if the timer has been missed finishing. Here is a breakdown of the program and what it does:

Lines 30 to 190	Minimum three-letter word game on a four by four grid.
Lines 380 to 636	Letters as displayed on the grid.
Lines 700 to 732	Timer.
Lines 734 to 744	Attracts players' attention that the game is about to start.
Lines 750 to 860	Timer countdown.
Lines 870 to 890	Blank out screen to end game.
Lines 892 to 910	Re-display grid with scoring details.
Lines 920 to 1140	Introduction.
Lines 1150 to 3120	Instructions and rules.
Lines 3125 to 3150	Choice of grid size.
Lines 4000 to 4180	Minimum four letter word game on a five by five grid.

This program chooses a random letter from one "die" and then randomly places that letter on the grid. This is achieved by putting all the letters into one string and using the string slicing to remove one die at a time. The machine-code routine at the beginning of the program is used to find an empty position on the grid in which to print the letter.

I would like to give credit to Alan Potter of Glasgow for this routine. It is much quicker than the

LET P = PEEK (PEEK 16398 + 256*PEEK 16399)

Basic line and reduces the time waiting for the grid to be set up.

Direct commands

When typing in the program line 1 is typed as:

1 REM E : RND ? ▖ TAN

or the line can contain seven characters and then entering as direct commands:

POKE 16514,42
POKE 16515,14
POKE 16516,64
POKE 16517,78
POKE 16518,6
POKE 16519,0
POKE 16520,201
POKE 16510,0

Line 1 now becomes 0 and the rest of the program can now be entered.

```
   0 REM E:RND?▖ TAN
   1 REM "BOGGLED"  BY D.H.HARRIS
   MAY 1983"
  10 CLS
  20 GOTO 940
  30 LET A$="...EHIYEKGLYUEDSNWOELRWGUIFBR...DJZTICADFCEPADMARELSCHRSMAOIAEIL...YTESUPLJABOOM"
  35 FAST
  40 LET U$="."
  50 FOR F=1 TO 16
  60 LET B$=A$( TO 6)
  70 LET R=INT (RND*6)+1
  80 LET C$=B$(R)
  90 LET A$=A$(7 TO )
 100 GOSUB ((CODE C$)+10)
 110 LET R=INT (RND*4)
 120 LET X=R*5
 130 LET R=INT (RND*4)+1
 140 LET Y=R*5
 150 PRINT AT Y,X+4;
 160 LET P=USR 16514
 170 IF P<>0 THEN GOTO 110
 180 PRINT AT Y,X+4;U$;AT Y-1,X+4
 1;Z$;AT Y-2,X+1;Y$;AT Y-3,X-1;X$
 190 NEXT F
 200 GOTO 700
 380 LET X$="  "
 382 LET Y$="  "   A
 384 LET Z$="  "
 386 RETURN
 390 LET X$="  "
 392 LET Y$="  "   B
 394 LET Z$="  "
 396 RETURN
 400 LET X$="  "
 402 LET Y$="  "   C
 404 LET Z$="  "
 406 RETURN
 410 LET X$="  "
 412 LET Y$="  "   D
 414 LET Z$="  "
 416 RETURN
 420 LET X$="  "
 422 LET Y$="  "   E
 424 LET Z$="  "
 426 RETURN
 430 LET X$="  "
 432 LET Y$="  "   F
 434 LET Z$="  "
 436 RETURN
 440 LET X$="  "
 442 LET Y$="  "   G
 444 LET Z$="  "
 446 RETURN
 450 LET X$="  "
 452 LET Y$="  "   H
 454 LET Z$="  "
 456 RETURN
 460 LET X$="  "
 462 LET Y$="  "   I
 464 LET Z$="  "
 466 RETURN
 470 LET X$="  "
 472 LET Y$="  "   J
 474 LET Z$="  "
 476 RETURN
 480 LET X$="  "
 482 LET Y$="  "   K
 484 LET Z$="  "
 486 RETURN
 490 LET X$="  "
 492 LET Y$="  "   L
 494 LET Z$="  "
```

(continued on next page)

(continued from previous page)

```
495 RETURN
500 LET X$=""
502 LET Y$=""
504 LET Z$=""
505 RETURN
510 LET X$=""
512 LET Y$=""
514 LET Z$=""
515 RETURN
520 LET X$=""
522 LET Y$=""
524 LET Z$=""
525 RETURN
530 LET X$=""
532 LET Y$=""
534 LET Z$=""
535 RETURN
540 LET X$=""
542 LET Y$="U"
544 LET Z$=""
545 RETURN
550 LET X$=""
552 LET Y$=""
554 LET Z$=""
555 RETURN
560 LET X$=""
562 LET Y$=""
564 LET Z$=""
565 RETURN
570 LET X$=""
572 LET Y$=""
574 LET Z$=""
575 RETURN
580 LET X$=""
582 LET Y$=""
584 LET Z$=""
585 RETURN
590 LET X$=""
592 LET Y$=""
594 LET Z$=""
596 RETURN
600 LET X$=""
602 LET Y$=""
604 LET Z$=""
606 RETURN
610 LET X$=""
612 LET Y$=""
614 LET Z$=""
616 RETURN
620 LET X$=""
622 LET Y$=""
624 LET Z$=""
626 RETURN
630 LET X$=""
632 LET Y$=""
634 LET Z$=""
636 RETURN
700 FOR F=0 TO 18
710 PRINT AT F,25;""
720 NEXT F
730 PRINT AT 19,24;""
732 PRINT AT 20,23;" TIMER "
734 FOR F=1 TO 40
736 FAST
740 SLOW
744 NEXT F
750 FOR E=0 TO 18
760 FOR F=1 TO 38
770 NEXT F
780 FOR F=1 TO 20
790 PRINT AT E,25;"";AT E,26;"
"
800 NEXT F
810 FOR F=1 TO 30
820 NEXT F
830 FOR F=1 TO 20
840 PRINT AT E,26;"";AT E,26;"
"
850 NEXT F
860 NEXT E
870 FAST
880 FOR F=1 TO 200
885 NEXT F
890 SLOW
892 PRINT AT 20,1;"LETTERS    3.
4.5.6.7.8 OR MORE"
894 PRINT AT 21,1;"POINTS     1.
1.2.3.5.11"
900 PRINT AT 6,25;"PRESS";AT 7,
25;"ANY   ";AT 8,25;"KEY   ";AT 9,
25;"TO    ";AT 10,25;"CLEAR";AT 1
1,25;"THE   ";AT 12,25;"SCREEN"
910 IF INKEY$="" THEN GOTO 910
920 CLS
930 PRINT AT 5,5;"THANK YOU FOR
PLAYING"
940 GOSUB 390
950 PRINT AT 12,3;Z$;AT 11,3;Y$
;AT 10,3;X$
960 GOSUB 520
970 PRINT AT 12,7;Z$;AT 11,7;Y$
;AT 10,7;X$
980 GOSUB 440
990 PRINT AT 12,11;Z$;AT 11,11;
Y$;AT 10,11;X$
1000 PRINT AT 12,15;Z$;AT 11,15;
Y$;AT 10,15;X$
1010 GOSUB 400
1020 PRINT AT 12,19;Z$;AT 11,19;
Y$;AT 10,19;X$
1030 GOSUB 420
1040 PRINT AT 12,23;Z$;AT 11,23;
Y$;AT 10,23;X$
1042 GOSUB 410
1046 PRINT AT 12,27;Z$;AT 11,27;
Y$;AT 10,27;X$
1050 PRINT AT 15,0;"      WOULD Y
OU LIKE A GAME ?"
1060 PRINT AT 17,6;"  PRESS YES
OR NO"
1070 FOR F=1 TO 10
1080 NEXT F
1090 PRINT AT 17,6;"  PRESS YES
OR NO"
1100 FOR F=1 TO 10
1110 NEXT F
1120 IF INKEY$="Y" THEN GOTO 115
0
1130 IF INKEY$="N" THEN NEW
1140 IF INKEY$<>"Y" OR INKEY$<>"
N" THEN GOTO 1060
1150 CLS
1160 PRINT AT 5,0;"DO YOU WANT I
NSTRUCTIONS ? (Y/N)"
1170 IF INKEY$="Y" THEN GOTO 300
0
1180 IF INKEY$="N" THEN GOTO 199
0
1190 IF INKEY$<>"Y" OR INKEY$<>"
N" THEN GOTO 1160
1990 CLS
1995 GOTO 3105
3000 CLS
3020 PRINT "THE OBJECT OF BOGGLE
D IS TO LISTAS MANY WORDS OF (TH
REE ON 4*4  GRID, FOUR ON 5*5 GR
ID) OR MORE LETTERS (AS SHOWN ON
 BOARD)      WITHIN THE TIME LIMI
T."
3030 PRINT "RULES",,"       "
3040 PRINT "1. USE ADJOINING LET
TERS ONLY        (IN ANY DIRECTION
) IN CORRECT   SEQUENCE."
3050 PRINT "2. INDIVIDUAL LETTER
S CANNOT BE    USED MORE THAN ON
CE IN ANY       ONE WORD."
3060 PRINT "3. PROPER NAMES,ABBR
EV. AND         WORDS WITH APOSTR
OPHES OR        HYPHENS ARE NOT A
CCEPTABLE."
3070 PRINT "SCORING",,"       "
3080 PRINT "DUPLICATED WORDS ARE
 CROSSED OFFALL LISTS.REMAINING
WORDS ARE   SCORED AS IN POINTS
TABLE AT ENDOF GAME. PRESS A KEY
 TO CONTINUE"
3090 PAUSE 4E4
3105 CLS
3110 PRINT AT 10,0;"PLEASE INPUT
 WETHER A 4*4 OR 5*5BOARD IS REQ
UIRED,ENTER A 4 OR 5FOLLOWED BY
NEWLINE."
3120 INPUT G
3125 CLS
3130 IF G=4 THEN GOTO 30
3140 IF G=5 THEN GOTO 4000
3150 IF G<>4 OR G<>5 THEN GOTO 3
105
4000 LET A$="AFAARSFFIYSAAOGUUAA
IYPAAAYIFASGMEAUECTESCNOOUNTUIEP
CSTAEAEEELTTEICXJKBOZELPTTCLOHOA
HNOLOHREEEEEAHOEHTTTONANENCOOTUTA
ISFAANDLOHRIEIITTHTDODNMGFENNSSS
NUE"
4010 FAST
4020 LET W$="."
4030 FOR F=1 TO 25
4040 LET B$=A$( TO 6)
4050 LET R=INT (RND*6)+1
4060 LET C$=B$(R)
4070 LET A$=A$(7 TO )
4080 GOSUB ((CODE C$)*10)
4090 LET R=INT (RND*5)
4100 LET X=R*4
4110 LET R=INT (RND*5)+1
4120 LET Y=R*4
4130 PRINT AT Y,X+3;
4140 LET P=USR 16514
4150 IF P<>0 THEN GOTO 4090
4160 PRINT AT Y,X+3;L$;AT Y-1,X;
Z$;AT Y-2,X;Y$;AT Y-3,X;X$
4170 NEXT F
4180 GOTO 700
5000 SAVE "BOGGLE"
5100 RUN
```

BMX rider

AJ Herbert,
London SW4.

DRAGON

FOR THOSE OF you who enjoy BMX riding, here is a hi-res game which you should like. It consists of a BMX which, with your aid, must traverse a tough course. Control is via the right-hand joystick. Moving the joystick to the left or moving it down will pull the BMX into a wheelie. Pressing the fire button will make the bike jump into the air.

There are four main obstacles which have to be avoided.

Brick — hitting one of these will cost you 500 points. They may be wheelied or jumped over.

Fence — ramming one of these will also cost you 500 points. They may only be jumped over.

Hole — falling down a hole will knock you off the bike and the same will end.

Ledge — if you see a ledge at any time during the game, you must jump up on to it. If you do not land on the ledge, then you will fall off the bike and the game will end.

At the bottom of the screen are a number of drink bottles. These determine the speed at which your score will increase. During the game, however, this will slowly decrease. To help stop this, you will find bottles of drink in places along the course. Providing you are not in the middle of a jump or a wheelie, the drink will be collected and added on at the bottom. You will also score 2,000 points for this

To set up the game, type in Program 1. This is the main program which is written in Basic. When you have typed this in, do not try to Run the program yet. First of all, Save it by typing:

CSAVE "B.M.X."

Now type New to clear this program. You may now type in program 2. This program produces a machine-code scroll. Now you should Run this and then type:

CSAVEM "M/C",26001,26028,26001

So now, on your tape, you should have the program BMX followed by M/C. To Load the finished program type Cload.

Now you should Run the Loaded program and leave the tape running for the machine-code scroll to load. The game will now begin.

Program 1.

```
1 REM   =============
2 REM   === B M X ===
3 REM   === RIDER ===
4 REM   =============
5 REM
9 CLOADM
10 CLEAR 300,26000:PCLEAR8
11 PMODE4,1:COLOR0,5:PCLS
12 DRAW"BM5,1GD2FGD2FR3D3R2HU3L3U2NR4U2N
RU2NRUGD6FDG3FRG2U12U2R"4RUED"ODF2RE2U1
2L3RFH2UHUHEDL
13 DIMBMX(17,16):GET(0,0)-(17,16),BMX,G:
PCLS
14 DRAW"BM5,0GD2FGD2FR3D3R2HU3L3U2R2E8L
4UNRU2NRUGD6FDGDG2EHL62DF2RE2UERER2BE2F2
RE2UH2LG2EFH3G"
15 DIM SINT(17,16):GET(0,0)-(17,16),SINT
,G:PCLS
16 DRAW"B10,0R2D2LCLD2NRD7R2NUR2U2FLU2LU
GD":DIMDRNK(4,7):GET(0,0)-(4,7),DRNK,G:P
CLS
17 PMODE4,5:COLOR0,5:PCLS
18 DIM BL(11,16):GET(0,0)-(11,16),BL,G
19 LINE(16,118)-(255,118),PSET:LINE(48,0
)-(202,44),PSET,BF
20 DRAW"C1BM50,2D39R39U15LHLHLHLHUEREREK
ERU15L39BM60,7R14D5G4L10U8BM60,36U9R10F4
D5L13C0":PAINT(55,5),1,1
21 DRAW"C1BM100,2D39R9U29EFRF2RF2RF2RF2R
3E2RE2RE2RE2RERU29R9U39L10GL02LG2LGLG3L3
H3LH2LH2LH2L10C0":PAINT(105,5),1,1
22 DRAW"C1BM160,2M130,42M200,42M170,2M16
3,2BM190,2M160,42M170,42M200,2M190,2":PA
INT(165,5):PAINT(195,5):PAINT(165,40):PA
INT(195,40):PAINT(180,20) COLOR0,5
23 PUT(115,25)-(133,41),SINT,PRESET
24 LINE(72,167)-(172,180),PSET,BF:FORN=1
TO10:PUT(N*10+65,170)-(N*10+69,177),DRNK
,PRESET:NEXTN:LINE(73,165)-(174,182),PSE
T,B
25 PUT(40,100)-(57,116),BMX,PSET:SCREEN1
,1
26 FORN=1TO4:LINE(80,104)-(80,117),PSET:
PLAY"T255L255V31O1CD2CD3CD4CD5C":LINE(80
,104)-(80,117),PRESET:FORM=1TO500:NEXTM,
N
27 PMODE4,5:COLOR2,5:SCREEN1,1:PMODE4,1:
COLOR0,5
28 PCOPY8TO4
29 LINE(16,118)-(255,118),PSET
30 BMX=100:UP=-999:TYPE=1:TRAK=1:HITE=1
8:POKE&HFFD7,0:DRNK=0
31 TRAK$(1)="FRER2F2":TRAK$(2)="BDRERFR2
E":TRAK$(3)="F2DF1E":TRAK$(4)="DD7REUERE
3U"
```

```
32 FORM=1TO10:FORN=1TO2:PUT(40,BMX)-(51,
BMX+16),BL,PSET:EXEC2300:PUT(40,BMX)-(5
1,BMX+16),DL,PSET
33 IFUP>-999THENBMX=BMX+UP:IFPPOINT(42,B
MX+10)=0THENUP=-999:TYPE=1
34 IF UP<>-999 THEN UP=UP+8:WHEEL=0
35 IF UP>16 THEN UP=16
36 ON TYPE GOSUB 53,60
37 IF RND(10)=5 AND N=1 AND TRAK=1 THEN
TRAK=2ELSEIFRND(20)=5 AND N=1 THEN GOSUB
 55
38 ON TRAK GOSUB 63,64,63
39 IF RND(40)=5 AND TRAK=1 THEN DRAW"BM2
53,"+STR$(HITE-1)+"EDU14"
40 IF RND(10)=5ANDTRAK=1THENDRAW"BM251,"
+STR$(HITE-1)+"U2R3D2L3"
41 IFTRAK=1ANDRND(30)=5THENPUT(250,HITE-
10)-(254,HITE-11),DRNK,PSET
42 PCOPY1TO5:PCOPY3TO7
43 IF (PEEK(65280)AND1)<>1 AND UP=-999TH
EN UP=-16:TYPE=2
44 IF(JOYSTK(0)=0ORJOYSTK(1)=63)ANDWHEEL
=0THEN WHEEL=5:TYPE=2
45 IF WHEEL>0THENWHEEL=WHEEL-1:IFWHEEL=0
THENTYPE=1
46 IFBMX>100THEN65
47 IF(PPOINT(42,BMX+18)=5ANDUP=-999)OR(P
POINT(58,BMX+18)=5ANDTYPE=1)THEN UP=-1:T
YPE=2
48 S=S+DRNK
49 READ PL,PL$
50 PLAY"T800"+STR$(PL)+PL$+"O"+STR$(PL+1
)+PL$
51 NEXTN:IFTRAK=3 THEN TRAK=1
52 IF TRAK=2 THEN TRAK=3
53 NEXTM:RESTORE:IFDRNK>0THENLINE(DRNK*1
0+65,170)-(DRNK*10+69,177),PSET,BF:PCOPY
4TO8:DRNK=DRNK-1
54 GOTO32
55 IF HITE=118 THEN HITE=.02 ELSE HITE=1
18:RETURN
56 PUT(40,BMX)-(57,BMX+16),BMX,PSET
57 IFPPOINT(53,BMX+17)=0THENPLAY"O1V31CV
27CV23CV19CV15CV11CV7CV3C":S=S-500:IFS<0
THENS=0
58 IFPPOINT(60,BMX+4)=8THENPLAY"V31O1C02
C03C04C05C01E02E03E04E05E01G02G03G04G05G
":S=S+2000:IFDRINK<10THENDRNK=DRNK+1:PUT
(DRNK*10+65,170)-(DRNK*10+69,177),DRNK,P
RESET:PCOPY4TO8
59 RETURN
60 PUT(40,BMX)-(57,BMX+16),DINT,PSET
61 IFPPOINT(62,BMX+10)=0THENPLAY"O1V31CV
27CV23CV19CV15CV11CV7CV3C":S=S-500:IFS<0
THENS=0
62 RETURN
63 DRAW "BM247,"+STR$(HITE)+TRAK$(N):RET
URN
64 DRAW "BM247,"+STR$(HITE)+TRAK$(N+2):R
ETURN
65 CLS:PLAY"V31":FORZ=1TO2:FORV=0TO1STEP
-1:A$=STR$(V):PLAY"O1;"+A$+"O2;"+A$+"O3;
"+A$+"O4;"+A$+"O5;"+A$:NEXTV,Z
66 PRINTSTRING$(38,"*");" G A M E    O V
 E R ";STRING$(38,"*")
67 S=S/1000000:PRINT,,,"     SCORE.....
......";:PRINTUSING".#####";S
68 DRNK=DRNK/100:PRINT,,"     DRINK.....
..........";:PRINTUSING".##";DRNK
69 PRINT,,,," PRESS SPACE BAR TO PLAY AG
AIN."
70 SCREEN0,1
71 IFINKEY$<>" "THEN71
72 PLAY"O1G02F03E04D05C"
73 RUN10
74 DATA 2,"V31C",2,"V0C",2,"V31G",2,"V0C
",2,"V31C",2,"V0C",1,"V31G",1,"V31A#"
75 DATA 2,V31C,2,V0C,2,V31G,2,V03,2,V31C
,2,V0C,1,V31G,1,V31A#,2,V31C,2,V0C,2,V31
G,2,V03,2,V31C,2,V0C,2,V31C,2,V31D#
76 DATA 2,V31F,2,V0C,3,V31C,3,V0C,2,V31F
,2,V0C,1,V31G,1,V31A#
77 REM
78 REM ================
79 REM = A.J.HERBERT =
80 REM ===== AND ====
81 REM == J.P.DOWER ==
82 REM ================
```

Program 2.

```
10 CLEAR 200,26000
20 FOR N=26001 TO 26028
30 READ A$
40 POKE N,VAL("&H"+A$)
50 NEXT N
60 END
100 DATA 8E,0C,00,A5,01,A7,80,AC,10,26
110 DATA 25,F7,8E,0C,00,86,FF,A7,84,30
120 DATA 88,20,8C,18,1F,25,F6,39
```

Guess-Who-Man

AJ Hodgson,
Bury,
Lancashire.

VIC-20

FOR THOSE of you who were disappointed at being unable to load Hermann Hirsch's Vicman program in the January edition of *Your Computer* because you did not have the required memory, here is another program entitled Guess-Who-Man which will run comfortably on the unexpanded Vic-20, leaving enough space for a small but quite useful monitor.

You will probably be familiar with the basic idea of the game by now: you guide your man around a maze, gobbling up dots/power pills/oxygen tablets as you go while a number of particularly vicious ghosts/taxmen/monsters try to catch you. Normally the monsters are inedible but by eating an ambiguous diamond shaped object these monsters change colour and can then be eaten.

Features that my game includes are:
Three melodies
Four very intelligent ghosts
On-screen scoring
Highest score displayed
100 percent machine-code action

The code itself, including screen, graphics and tunes data occupies just over 2,700 bytes, which leaves enough room for the simple monitor in figure 1. You do not have to use my monitor, but make sure that the one you use does not require any of the locations 4976-7679 inclusive. If you have the 3K expansion it will be possible to use a much longer, more sophisticated, and more user-friendly monitor.

If you want to use my monitor, then type it in exactly as shown, because it only just fits into the 880 bytes when variable storage space is included, and save it on tape. On running it you will be asked FI? Typing Y at this point will load any machine code that you have previously entered and saved on tape — it is advisable to use a separate cassette for the Guess-Who-Man program so that you know exactly where this code is saved — otherwise you may load the wrong program and will also waste time in positioning the cassette.

Typing anything except Y after FI? will take you to the prompt ST ADD? and at this point you should enter the decimal location at which you are going to start typing the code which is listed in figure 2: locations are in decimal, the code is in hexadecimal.

If you enter V after ST ADD? you will be able to view 15 bytes of code, the locations of the first byte being decided by your entry after the prompt WH?. If you entered SA after ST ADD the code will be saved on to tape with no name.

If you just entered a start address then you will be asked Co [Location]? after which should be entered the hexadecimal number for the relevant location, as listed in figure 2. You will be asked for 15 bytes of code before being asked for a start address again. Both V and SA can be entered after the code prompt and have exactly the same effect as previously.

When you have completed the task of typing in all the hex — and it is advisable to spread this job over a few days to minimise the risk of error — you should save it, just to be on the safe side. Now to test it enter:
POKE 36879, 14:POKE 36878,15: SYS4973

You should now hear a version of Bach's *Toccatta and Fugue* in D Minor which should at least sound tuneful, and noting else will happen. If you press F1, though, you should be taken into the game itself which you should play for a while so as to thoroughly test it — movement keys are Z for left, X for right, K for up, and M for down.

Now reset and new the Vic, and enter the presentation program listed in figure 3 and Save it, without rewinding the tape afterwards. Re-load the monitor, and run it, typing N when asked FI? and enter SA after ST ADD? Now it is possible to save the code immediately after the presentation program.

To run, load the presentation program and run it — this program will automatically load and run the machine code.

Figure 1.

```
1 POKE55,112:POKE56,19:POKE51,112:POKE52,19
10 INPUT"FI";A$:IFA$<>"Y"THEN20
11 POKE780,2:POKE781,1:POKE782,0:SYS65466:POKE780,0:POKE781,251:POKE782,252:SYS6
5469
12 POKE780,0:POKE781,0:POKE782,21:SYS65493:RUN
20 INPUT"ST ADD.";S$:IFS$="SA"THEN50
21 IFS$="V"THEN70
22 S=VAL(S$):Q=0
30 PRINT"CO";S;:INPUTC$
31 IFC$="SA"THEN50
32 IFC$="V"THEN70
35 GOSUB100:POKES,V:IFQ<>14THENQ=Q+1:S=S+1:GOTO30
40 GOTO20
50 POKE780,1:POKE781,1:POKE782,1:SYS65466:POKE780,0:POKE781,251:POKE782,252:SYS65
487
60 POKE251,112:POKE252,19:POKE780,251:POKE781,255:POKE782,29:SYS65496:END
70 INPUT"WH";S:FORA=WTOW+14:A$=""
72 B=PEEK(A):N=INT(B/16)+1:GOSUB200:N=B-INT(B/16)*16+1:GOSUB200:PRINTA;A$:NEXT:G
OTO20
100 D$=LEFT$(C$,1):E$=RIGHT$(C$,1):V=(ASC(D$)-48+(ASC(D$)>64)*7)*16
110 V=V+(ASC(E$)-48+(ASC(E$)>64)*7):RETURN
200 A$=A$+MID$("0123456789ABCDEF",N,1):RETURN
```

Figure 2.

```
1 POKE36879,14:POKE36878,15:PRINT"     GUESS-WHO-MAN!     "
5 PRINT"  GUESS-WHO-MAN IS A  GAME OF THE PAC-MUC-  MUC-PACMAN GENRE."
10 PRINT"USE THESE KEYS -
15 PRINTTAB(15)"Z-X-K-M"
20 PRINT"MONSTERS SCORE 200"
25 PRINT"DOTS SCORE 10"
30 PRINT"FRUIT SCORES RANDOMLY"
35 PRINT"HIT A KEY"
40 POKE198,0:WAIT198,1
45 PRINT"(C) ALLAN HODGSON 1984"
50 PRINT""
111 POKE780,2:POKE781,1:POKE782,0:SYS65466:POKE780,0:POKE781,251:POKE782,252:SYS
65469
112 POKE780,0:POKE781,0:POKE782,21:SYS65493
115 PRINT"    HIT F1 TO START."
120 SYS4976
```

(continued on page 159)

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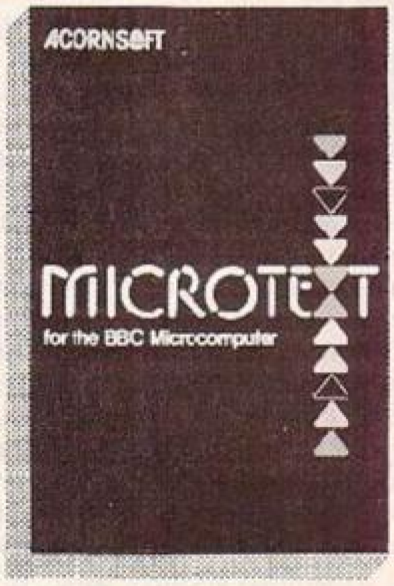
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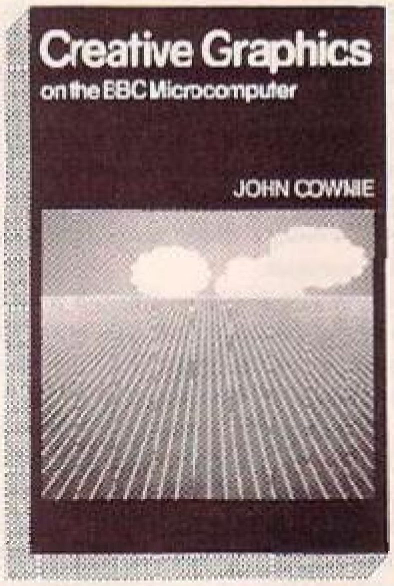
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(continued from page 157)

Figure 2.

```
4970                            A2 0E 20 75
4980 1F 20 0C 13 A2 07 20 75 1A A9
4990 FF 8D 6C 03 A9 50 8D 6D 03 A9
5000 84 8D 70 03 A9 1C 8D 6F 03 A9
5010 C1 8D 6E 03 A9 12 8D 71 03 A9
5020 1F 8D 72 03 A9 3C 8D 6F 03 A9
5030 0E 8D 69 03 8E 59 03 A6 1C A0
5040 1E 9D 36 03 9D 64 03 37 03 9D
5050 35 03 9D 3A 03 F0 20 9E 39 03
5060 A9 01 9D 3B 03 20 71 1E D0 E1
5070 A9 E8 8D 3C 03 A9 19 8E 40 03
5080 A9 01 8D 41 03 F2 D3 9E 43 03
5090 E8 8E 4A 03 E8 8E 51 03 A9 93
5100 20 D2 FF 20 1E 1E A2 05 8E 00
5110 1E E8 8E 01 1E E8 8E 02 1E E8
5120 8E 0D 1E E8 8E 0E 1E A9 16 85
5130 F3 A9 1E 85 FC A9 37 85 FD 18
5140 A9 14 85 FE A0 00 B1 FB C9 FF
5150 D0 03 4C 1D 16 91 FB 20 E0 1B
5160 A5 FD 18 69 01 85 FD A5 FE 69
5170 00 85 FE D0 E3 20 0F 13 13 13
5180 13 13 13 13 13 13 13 13 13 13
5190 13 13 13 13 13 13 10 20 14 08
5200 06 06 06 06 06 06 06 06 06 06
5210 06 06 06 06 06 06 06 06 14 00
5220 14 06 0F 13 13 15 13 13 13 13
5230 06 13 13 13 13 15 13 13 10 06
5240 14 20 14 06 14 20 20 14 06 06
5250 06 06 06 06 06 06 06 14 20 20
5260 14 06 14 0A 14 06 14 20 20 14
5270 06 0F 13 10 06 0F 13 10 06 14
5280 20 20 14 06 14 20 14 06 12 13
5290 13 17 06 12 13 11 06 12 13 11
5300 06 18 13 13 11 06 14 00 14 06
5310 06 06 06 14 06 06 06 06 06 06
5320 06 06 06 14 06 06 06 06 14 20
5330 14 06 0F 13 06 14 06 0F 13 13
5340 19 13 13 10 06 14 06 13 10 06
5350 14 20 14 06 14 06 06 14 06 14
5360 20 20 20 20 20 14 06 14 06 06
5370 14 06 12 13 11 06 14 06 06 06
5380 06 14 20 20 20 20 20 14 06 06
5390 06 06 14 06 06 06 06 06 14 06
5400 05 14 06 12 13 13 13 13 13 11
5410 05 14 06 06 14 06 0F 13 10 06
5420 14 06 13 11 06 06 06 06 06 06
5430 05 06 06 12 13 06 14 06 14 07
5440 14 06 14 06 06 06 06 0F 13 13
5450 05 13 13 10 06 06 06 06 14 06
5460 14 20 14 06 06 06 13 13 13 11
5470 05 06 06 06 06 12 13 13 13 06
5480 05 06 14 07 14 06 14 05 06 06
5490 05 06 06 14 06 14 06 05 06 06
5500 05 06 14 06 14 20 14 05 12 13
5510 05 13 13 13 15 11 06 12 13 13
5520 13 13 06 13 11 06 14 07 14 06
5530 05 06 06 06 06 06 14 05 06 06
5540 14 06 06 06 06 06 06 05 14 20
5550 14 06 0F 10 06 13 13 05 14 06
5560 14 06 14 06 13 13 06 0F 10 06
5570 14 07 14 06 14 14 06 05 06 06
5580 14 06 14 06 14 06 06 05 06 14
5590 14 06 14 20 14 06 12 15 13 13
5600 05 13 11 06 14 06 13 13 06 13
5610 13 16 11 06 14 37 14 03 06 06
5620 06 06 06 06 06 06 06 05 06 06
5630 06 06 26 05 05 08 14 20 12 13
5640 13 13 13 13 13 13 13 13 13 13
5650 13 13 13 13 13 13 13 13 11 FF
5660 20 A9 0E A2 03 CA 9D 0A 1E D0
5670 FA A9 FF 8D 05 90 A2 DC A9 05
5680 9D F2 96 9A 38 E9 2C AA D0 F4
5690 20 69 1B 20 31 1B A9 84 38 E9
5700 70 03 F0 0C A0 F0 20 20 16 1E
5710 8A 38 E9 2C D0 F4 20 40 1B A9
5720 00 85 FB 85 FC 20 AD 1B A9 B7
5730 8D 08 90 AD 72 03 C9 20 90 03
5740 4C 40 19 4C 7A 16 16 A9 84 20
5750 26 18 18 18 FD 71 03 95 FB AD
5760 72 03 95 FC F5 C5 C9 21 D0 07
5770 A8 20 C4 1B 4C B7 16 C9 1A D0
5780 07 A8 20 30 1B 4C B7 16 C9 2C
5790 D0 07 A8 20 E6 1B 4C B7 16 C9
5800 24 D0 07 A8 20 D2 1B 4C B7 16
5810 AD 6A 03 D0 CF 8D 6F 03 A0 00
5820 B1 FB 85 01 C9 05 D0 0D A9 01
5830 A2 05 20 85 1A C6 0E 03 4C 19
5840 17 C9 20 F0 F9 C9 04 D0 1C 20
5850 02 1B AD 37 03 C9 04 F0 0F 18
5860 18 20 A0 1A A9 04 20 26 1B A6
5870 00 4C 01 18 4C C0 19 C5 07 D0
5880 0F A5 A2 29 05 A2 04 20 85 1A
5890 18 18 18 4C 19 17 C9 08 D0 36
5900 A2 00 86 A1 E8 8E 69 03 A9 05
5910 20 26 1B A9 4A 37 20 D1 1A A0
5920 00 91 FB AD 71 03 85 FD AD 72
5930 03 85 FE A9 20 91 FD A5 FB 8D
5940 71 03 A5 FC 8D 72 03 20 F1 1A
5950 A9 01 91 FB AD 6E 03 D0 03 4C
5960 43 19 A5 A2 38 19 A0 6F 03 F0
5970 29 AD 3F 1F C9 20 D0 0I A9 07
5980 8D 3F 1F A9 05 8D 3F 97 20 19
5990 1B A5 A2 C9 FF D0 0F AD 3F 1F
6000 C5 0F D0 06 A9 20 8D 3F 1F 18
6010 18 18 A2 1C 86 00 A6 00 20 E6
6020 1F 8D 37 03 C9 05 F0 51 20 B6
6030 1B 20 86 1B E0 01 F0 F6 A9 00
6040 85 01 E0 02 F0 50 20 C6 1A 20
6050 D2 1B 20 86 1B E0 01 F0 F6 A9
6060 01 85 01 E0 02 F0 39 20 E6 1A
6070 20 C4 1B 20 36 1B E0 01 F0 F6
6080 A9 02 85 01 E0 02 F0 24 20 E6
6090 1A 20 E0 1B 20 86 1B E0 01 F0
6100 F6 A9 03 85 01 E0 02 F0 0F 20
6110 EA FF A5 A2 18 29 03 A6 00 DD
6120 3B 03 F0 F1 85 01 A6 00 2E E6
6130 1A A5 01 D0 06 20 B6 1B 4C 14
6140 18 C9 01 D0 06 20 D2 1B 4C 14
6150 19 C9 02 D0 06 20 C4 1B 4C 14
6160 19 20 E0 1B A0 00 B1 FB C1 59
6170 03 D0 12 A6 00 3D 37 03 C5 04
6180 D0 03 4C 68 19 20 86 1A 4C E5
6190 16 C9 04 F0 04 C9 05 D0 39 8A
6200 A8 20 02 1B B9 35 03 85 FB B9
6210 36 03 85 FE B9 37 03 04 02 A0
6220 00 91 FD 18 A5 FE 69 78 85 FE
6230 A4 02 B9 3A 03 A0 00 91 FD A4
6240 02 4C EB 18 99 3A 03 B7 38 03
6250 99 39 03 4C 70 1A F2 05 A0 A0
6260 B1 F3 DD DB 1D F0 06 CA D0 F9
6270 4C DF 17 A6 00 BD 35 03 85 FD
6280 B7 36 03 85 FE BD 39 03 A0 00
6290 91 FB 18 A5 FE 59 78 85 FE 8D
6300 39 03 91 FD 20 F1 1A B1 FB 9D
6310 39 03 20 F9 1A B1 FB 90 39 03
6320 95 FB C9 BB D0 17 A5 FC C9 1E
6330 D0 11 A0 01 9D 3B 03 A9 04 9D
6340 37 03 9D 3F 03 A9 00 85 01 A5
6350 01 49 01 9D 3B 03 A5 FE 9D 3D
6360 03 A5 FC 9D 36 03 BD 38 03 91
6370 FB 20 F1 1A B1 37 03 91 FB A6
6380 00 20 7E 13 F0 0A 86 00 A9 00
6390 8D 0D 90 4C 0C 17 AD 6C 03 85
6400 FB AD 6D 03 85 FC 20 AD 1B 4C
6410 60 16 F2 64 A5 3C 85 FC 3D 10
6420 19 8D CB 90 A5 C5 C9 27 30 06
6430 A9 00 8D 03 9E 60 60 49 30 12
6440 A9 1E 85 FC 18 18 20 AD 1B F9
6450 3C 85 FC 4C 31 19 18 18 20 FD
6460 1B CA D0 CE 4C 0C 19 A2 23 F9
6470 38 85 FC 8D 33 1A 8D 08 30 20
6480 AD 1B CA D0 F0 A2 03 A9 31 20
6490 85 1A AD 63 03 38 E9 04 3D 6D
6500 03 4C 91 13 A2 18 8D 57 1A 85
6510 FC 20 C2 19 8D 0B 90 20 9D 1F
6520 CA 20 [illegible] 4C 19
6530 70 03 F0 03 4C 91 13 A2 00 8D
6540 5A 03 8D 61 03 90 0A DD 51 03
6550 D0 03 E8 E3 06 D0 EE 4C 4B 19
6560 A2 37 BD 53 03 79 C0 03 CA D0
6570 F7 42 17 B0 E2 1D 20 D2 FF CA
6580 D0 F7 A9 F7 95 FC 20 AD 1B 20
6590 0C 19 4C 73 13 00 8D 0B 90 8D
6600 5C 1A A9 03 89 D0 F5 CA 60 90
6610 E7 87 B7 B7 B7 90 D8 00 B7 80
6620 D8 30 C7 AF BF C9 BF AF BF C9
6630 BF B7 C3 CF C3 B7 C3 CF C9 B8
6640 C9 D1 C9 DB C9 D1 C9 C3 CF B7
6650 CF C3 CF D7 CF C9 D1 DB D1 C9
6660 D1 DB D1 CF D7 DD D7 CF D7 DD
6670 D7 D8 B7 B7 00 B7 00 B7 00 B7
6680 00 C9 C7 CF C9 D1 CF D7 D1 DB
6690 D7 DD DB D7 D1 DB D7 D1 CF B7
6700 D1 CF C9 D1 CF C9 B7 B7 00 C3
6710 C3 C3 C3 E1 E1 E1 E1 E4 E4 DF
6720 E7 E7 E4 E1 E7 E5 E4 E1 00 E1
6730 E1 E1 E1 E1 CF E1 E1 CF E1 E1
6740 CF CB C9 C3 00 00 C3 C8 BF 32
6750 C3 96 C3 32 C3 96 C3 32 C3 96
6760 C3 C8 C3 32 C3 96 C3 C8 A6 00
6770 4C B0 13 A9 39 9D 50 03 C0 30
6780 FA 60 A6 00 BD 35 03 60 33 19
6790 7D 5A 03 C9 3A 90 0C 38 E9 0A
6800 9D 5A 03 A9 01 CA 4C 85 1A 9D
6810 5A 03 20 EE 13 60 20 02 1B A9
6820 07 9D 37 03 B0 39 03 86 00 91
6830 FF 20 F1 1A BD 3A 03 91 FB A9
6840 05 9D 38 03 A9 20 9D 39 03 A9
6850 E7 85 FB A9 1E 85 FC A9 02 A2
6860 04 20 85 1A 60 A5 6A 03 A2 0A
6870 DD D4 1D F0 04 CA CA D0 F7 3D
6880 D5 1D 8D 59 03 60 20 7E 1A 85
6890 FE BD 76 F3 95 FC 60 18 A5 FC
6900 69 75 85 FC 60 38 A5 FC E9 78
6910 85 FC 60 7F A2 1C A5 FE DD 35
6920 03 F0 06 20 7E 1E 4C 06 1B A5
6930 FC DD 36 03 30 F3 60 AD 6F 03
6940 29 E9 20 CD 6F 03 C0 C0 15 C0
6950 A2 1C 9D 37 03 20 7E 1B D0 F8
6960 60 A0 30 FD 71 03 95 FB AD 72
6970 03 95 FC AD 59 03 91 FB 60 EF
6980 EF 97 D6 FC A2 1C BD 35 03 95
6990 FB BD 36 03 95 FC BD 39 03 40
7000 00 91 FB 20 F1 1A BD 37 03 91
7010 FB 20 7E 1B D0 E2 60 F9 DC 35
7020 ED 6F 03 F0 0C AA A9 20 9D F2
7030 1E 9A 38 E9 2C D0 F4 60 CA CF
7040 CA CA CA CA CA 60 A0 C0 B1 F1
7050 C9 06 F0 0C C9 07 F0 00 C9 2E
7060 F0 04 C9 04 D0 03 A2 01 60 C9
7070 C9 08 D0 03 A2 02 60 F2 A0 60
7080 A0 06 20 04 07 C6 F8 10 FE C4
7090 FC D0 FE 60 38 A5 FB E9 16 85
7100 FB A5 FC E9 00 85 FC 60 38 A5
7110 FB E9 01 85 FB A5 FC E9 00 85
7120 FC 60 18 A5 FB 69 16 85 FB A5
7130 FC 69 00 85 FC 60 18 A5 FB 69
7140 01 85 FB A5 FC 69 00 85 FC 60
7150 F2 07 8I 59 03 9D 02 1E 8D 60
7160 E3 90 0A 1E CA D0 F1 60 1F 3E
7170 6C 73 7C 3E 1F 00 00 38 7C FE
7180 FA E3 C6 82 00 F8 5C 3E 1E 3E
7190 7C F3 82 C6 EE FA 7E 7C 38 00
7200 7E FE D7 FF C7 D7 FF AA 7E FF
7210 57 3F 1F 0F 07 02 00 00 00 38
7220 38 00 00 00 10 10 54 FE 7C 38
7230 10 00 10 38 7C FE 7C 38 10 00
7240 FF 11 77 17 D7 11 FF FF FF 11
7250 33 33 33 13 FF FF FF 1F 77 3F
7260 77 1F FF FF FF 51 5B 1B 5B 51
7270 FF FF FF 9A 7A 4B 5A 1A FF FF
7280 FF FF FF FF FF FF FF FF 03 00
7290 00 00 1F 10 10 10 30 00 03 00
7300 F0 10 10 10 10 10 10 10 F0 00
7310 00 00 10 10 10 10 1F 00 00 00
7320 00 00 00 00 FF 00 00 00 10 10
7330 10 10 10 10 10 10 00 00 00 00
7340 FF 10 10 10 10 10 10 10 FF 00
7350 00 00 10 10 10 10 F0 10 10 10
7360 10 10 10 10 1F 10 10 10 00 00
7370 00 34 00 00 00 00 7E 02 04 18
7380 20 40 7E 00 3C 20 20 20 20 20
7390 3C 00 0C 10 10 3C 10 70 6E 00
7400 3C 04 04 04 04 04 3C 00 00 08
7410 1C 2A 08 08 08 08 00 00 10 20
7420 7F 20 10 00 00 00 00 00 00 00
7430 00 00 00 00 00 00 00 00 08 08
7440 24 24 24 00 00 00 00 00 24 24
7450 7E 24 7E 24 24 00 08 1E 28 1C
7460 0A 3C 08 00 00 62 64 08 10 26
7470 46 00 30 48 48 30 4A 44 3A 00
7480 04 08 10 00 00 00 00 00 04 08
7490 10 10 10 08 04 00 20 10 08 08
7500 08 10 20 00 00 2A 1C 3F 1C 2A
7510 00 00 00 08 08 3E 08 08 00 00
7520 00 00 00 00 00 00 08 10 00 00
7530 00 7E 00 00 00 00 00 00 00 00
7540 00 10 10 00 00 02 04 08 10 20
7550 40 00 C3 BI B9 A5 9D BD C3 FF
7560 F7 E7 D7 F7 F7 F7 C1 FF C3 BD
7570 FD F3 CF BF 81 FF C3 BD FD E3
7580 FD BD C3 FF FB F3 EB DB 81 FB
7590 FB FF 81 BF 87 FB FD BB C7 FF
7600 E3 DF BF 83 BD BD C3 FF 81 BD
7610 FB F7 EF EF EF FF C3 BD BD C3
7620 BD BD C3 FF C3 BD BD C1 FD FB
7630 E7 FF FF 00 00 00 21 82 1A 00
7640 2C 03 24 01 06 07 00 20 19 05
7650 21 52 45 54 4F 20 45 4D 41 47
7660 1D 1D 1D 1D 1D 1D 12 1E 11 11
7670 11 11 1D 13 48 4F 2D 4D 41 EF
```

Pyramaniac

Andrew Gordon,
Bridge of Weir,
Renfrewshire.

ORIC

PYRAMANIAC IS a version of that arcade favourite Q Bert, and will I am certain be a favourite among readers of *Your Computer* who own an Oric.

You — alias a pair of eyes — are in a pyramid constructed of discs. The object of the game is to alter the colour of the discs by jumping on them. But this is not as easy as it might first appear. Throughout the game you are pursued by the aliens of the Mad Drummer who are sent by him to kill you. You must avoid these at all costs.

Occasionally the drummer himself makes an appearance and you will be able to wreak your vengeance on him, by killing him and so gaining points. In later screens you may have to change the colour of the discs more than once before you can complete the screen.

Instructions for using the game are included in the program; there is a constant update of your score; your lives are represented on the right of the screen, and the target colour of the discs is shown on the left.

```
0 GOSUB2000
5 GOSUB5000:GOTO6000
8 :
9 REM /// MAIN LOOP \\\
10 GOSUB3000:GOSUB4000:INK1:PLOTX+1,Y,
"cc"
15 REPEAT:PLAYO,1,3,RND(1)*400+50:GOSU
B200:GOSUB600:Z$=STR$(SC):PLO
T32,0,Z$
20 IFLM=TRUE THEN GOSUB 300
30 IFFG=TRUE THEN GOSUB 400
40 IFHI=TRUE THEN GOSUB 500
50 WAITW:PLOTX,Y,4::A$=KEY$:IFA$="" TH
EN90
60 PLOTX,Y,0:X=FNX(X):Y=FNY(Y):PLOTX,Y
,4:PLOTX+1,Y,"cc":V=SCRN(X,Y-
1)
70 GOSUB630:IF V=16 OR Y>20 THEN1500
80 IFV<E THENPLOTX,Y+1,V+1:SC=SC+10:IF
V-1=E THEN R=R+1
90 PLOT0,26,"
                 ":UNTILR=28:SS=S
S-1:RETURN
198 :
199 REM    !!! BALL !!!
200 IF TEST(1)<.75 THEN TEST(1)=RND(1)
:RETURN
210 PLOTA,B,0:IFB<20THENA=FNA(A):B=B+2
 ELSE B=B+1
215 PLOTA,B,1:PLOTA+1,B,"hi"
220 IF B>25 THEN B=7:A=15:TEST(1)=0:RE
TURN
230 IF A=X AND B=Y THEN1000
240 RETURN
298 :
299 REM    @@@ FOLLOW BALL @@@
300 IF TEST(2)<.75 THEN TEST(2)=RND(1)
:RETURN
310 PLOTL,M,0:IFM<20THEN L=FNC(L):M=M+
2 ELSE M=M+1
315 PLOTL,M,2:PLOTL+1,M,"fg"
320 IF M>25 THEN M=7:L=15:TEST(2)=0:RE
TURN
330 IF L=X AND M=Y THEN1000
340 RETURN
398 :
399 REM    ::: FOLLOWER :::
400 IFRND(1)<.8THEN RETURN
405 PLOTF,G,0:F=FNC(F):G=FNB(G):PLOTF,
G,5:PLOTF+1,G,"jk"
410 IF F=X AND G=Y THEN1000  ELSE RETU
RN
498 :
499 REM    ((( C.  SAM )))
500 IF TEST(3)<.75 THEN TEST(3)=RND(1)
:RETURN
510 PLOTH,I,0:IFI<20THENH=FNA(H):I=I+2
 ELSE I=I+1
515 PLOTH,I,3:PLOTH+1,I,"de":U=SCRN(H,
I+1)
520 IFU=E THENSC=SC+20:R=R-1 ELSE IF U
>S THEN SC=SC-10
530 PLOTH,I+1,S:IF I>24 THEN I=7:H=15:
TEST(3)=0:RETURN
550 IF H=X AND I=Y THEN:000
560 RETURN
598 :
599 REM    XxX POINT EYES XxX
600 IF TEST(4)<.95 THEN TEST(4)=RND(1)
:RETURN
610 PLOTJ,K,0:IFK<20THENJ=FNA(J):K=K+2
 ELSE K=K+1
615 PLOTJ,K,6:PLOTJ+1,K,"ln"
620 IF K>25 THEN K=7:J=15:TEST(4)=0:RE
TURN
630 IF J=X AND K=Y AND TEST(4)>.95THEN
K=7:SC=SC+100:J=15:TEST(4)=0:
RETURN
640 RETURN
998 :
999 REM    %%% CRUSHED SEQ %%%
1000 PLOTX,Y,"*!@":SHOOT:PLOTX-1,Y,1:W
AIT200
1002 CLS:PRINT"YOU WERE JUMPED ON":LI=
LI+1:WAIT300
1005 IFLI<3 THEN GOTO7000+SS*10
1010 PRINT:PRINT"YOU SCORED "SC:PLOT10
,26,"PRESS ANY KEY TO PLAY":G
ET A$:RUN
1498 :
1499 REM    ^^^ OUT LEAP SEQ ^^^
1500 ZAP:REPEAT:PLOTX,Y-1,0:PLOTX,Y,"A
AAH ":PLOTX-1,Y,5:Y=Y+1
1501 PLOTX,Y,"cc":PLOTX-1,Y,4:PLOTX+2,
```

(continued on page 161)

(continued from page 159)

```
Y,0:WAIT20:UNTILY=26:WAIT200
1502 CLS:PRINT"YOU JUMPED INTO OUTER S
PACE":LI=LI+1
1505 WAIT200:IFLI<3 THENGOTO7000+SS*10
1510 PRINT:PRINT"YOU SCORED "SC" POINT
S":PLOT10,26,"PRESS ANY KEY T
O PLAY AGAIN
1520 GET A$:RUN
1998 :
1999 REM   £££ DEFINE CHARS  £££
2000 FORC=1TO13:READA:FORD=0TO7:READB:
POKE46080+8*A+D,B:NEXTD,C:RET
URN
2010 DATA 97,7,31,63,63,31,47,26,7
2020 DATA 98,56,62,63,63,62,59,46,56
2030 DATA 99,12,18,33,45,45,30,12,0
2040 DATA 100,3,7,5,7,15,27,2,4
2050 DATA 101,48,56,40,62,58,48,16,32
2060 DATA 102,7,9,11,7,1,29,47,0
2070 DATA 103,56,36,52,56,32,46,61,0
2080 DATA 104,3,5,15,58,47,59,38,51
2090 DATA 105,48,24,52,63,21,63,41,51
2100 DATA 106,10,17,36,33,40,21,10,5
2110 DATA 107,42,1,40,1,42,20,40,16
2120 DATA 108,7,9,17,23,19,31,15,0
2130 DATA 109,56,36,34,58,50,62,60,0
2998 :
2999 REM   <<< REDEFINE VARS >>>
3000 A=15:L=15:F=15:H=15:J=15:B=7:M=7:
G=7:I=7:K=7:X=15:Y=15::::R=0
3010 TEST(1)=0:TEST(2)=0:TEST(3)=0:TES
T(4)=C:RETURN
3998 :
3999 REM   *** DEFINE SCREEN ***
4000 PING:CLS:LORES0:Z=48377:FORC=0TO6
:FORD=0TOC:DOKEZ+4*D,25185:PO
KEZ+4*D-1,S
4010 NEXTD:Z=Z+78:NEXTC:PRINT:PRINT"
        PYRAMANIAC":POKE48
082,10
4020 PRINT"                PYRAMANIAC":PO
KE48063,4:POKE48122,10:POKE40
123,2
4030 PRINT"CHANGE":PRINT"   TO":PRINT"
 ab":POKE48243,E:PRINT:PRINTS
C$
4040 FORC=1TO3-LI:PLOT 35,10+C,"cc":PL
OT34,10+C,4:NEXTC:RETURN
4998 :
4999 REM   ((( DEFINE FUNCTIONS )))
5000 DEF FNA(P)=P+2*SGN(RND(1)-.5)
5010 DEF FNC(P)=P+2*((X<=P)-(X>P))
5020 DEF FNG(P)=P-2*((Y>P)-(Y<=P))
5030 DEF FNX(P)=P+2*((A$="Q")+(A$="N")
-(A$="W")-(A$="M"))
5040 DEF FNY(P)=P+2*((A$="Q")+(A$="W")
-(A$="N")-(A$="M"))
5050 RETURN
5998 :
5999 REM ... INSTRUCTIONS ...
6000 CLS:INK0:FOR C=1TO24:READB$:PRINT
CHR$(27);B$:NEXTC
6010 DATA"Q  YOU ARE IN A PYRAMID CONS
TRUCTED OF"
6020 DATA"Q DISKS"
6030 DATA"R ab ab ab ab ab ab ab ab ab
 ab ab ab"
6040 DATA"V YOU MUST CHANGE ALL THE DI
SKS TO THE"
6050 DATA"V SPECIFIED COLOUR BY JUMPIN
G ON THEM"
6060 DATA"T WATCH OUT FOR THE ALIENS,S
ENT BY THE"
6070 DATA"T THE MAD DRUMMER"
6080 DATA"R fg AND hi BOUNCE DOWNWARDS
"
6090 DATA"R jk WILL FOLLOW YOU SO BE C
ARE FULL!"
6100 DATA"R de CHANGES THE DISKS COLOU
R AND"
6110 DATA"R KILLS YOU"
6120 DATA"U IF YOU KILL THE MANIAC DRU
MMER lm "
6130 DATA"U YOU WILL GAIN A GREAT DEAL
 OF POINTS"
6140 DATA"Q WATCH OUT OR HIS CEASLESS
DRUMMING"
6150 DATA"Q WILL SEND YOU MAD AS WELL
 !! !!!!"
6160 PLOT 10,26,"PRESS ANY KEY TO PLAY
":GET A$
6170 DATA"P","T YOU CAN ONLY JUMP DIAG
ONALLY"
6180 DATA"T  USING KEY Q FOR UP/LEFT"
6190 DATA"T              W     UP/RIGHT"
6200 DATA"T              N     DOWN/LEFT
"
6210 DATA"T              M     DOWN/RIGH
T"
6220 DATA"","","R BY ANDREW GORDON"
6998 :
6999 REM   === CONTROLING SEQ ===
7000 S=1:E=2:SC$="SCREEN 1":W=20:GOSUB
10
7010 S=3:E=4:SC$="SCREEN 2":W=15:LM=TR
UE:GOSUB10
7020 S=5:E=6:SC$="SCREEN 3":W=10:LM=0:
FG=TRUE:GOSUB10
7030 S=2:E=3:SC$="SCREEN 4":W=10:LM=TR
UE:GOSUB10
7040 S=1:E=3:SC$="SCREEN 5":W=15:FG=0:
LM=0:HI=0:GOSUB10
7050 S=6:E=7:SC$="SCREEN 6":W=5:FG=TRU
E:GOSUB10
7060 S=4:E=5:SC$="SCREEN 7":W=10:FG=0:
HI=TRUE:GOSUB10
7070 S=2:E=4:SC$="SCREEN 8":W=10:LM=TR
U:GOSUB10
7080 S=3:E=5:SC$="SCREEN 9":W=10:LM=0:
HI=TRUE:GOSUB10
7090 S=4:E=6:SC$="SCREEN10":W=5:LM=TRU
E:GOSUB10
7100 S=5:E=7:SC$="SCREEN11":W=5:FG=TRU
E:GOSUB10
7120 S=1:E=4:SC$="SCREEN12":W=10:FG=0:
HI=0:LM=C:GOSUB10
7130 S=2:E=3:SC$="SCREEN13":W=5:FG=TRU
E:HI=TRUE:GOSUB10
7140 S=3:E=6:SC$="SCREEN14":W=5:FG=FAL
SE:LM=TRUE:GOSUB10
7150 S=4:E=7:SC$="SCREEN15":W=0:FG=TRU
E:GOSUB10
7160 S=1:E=6:SC$="SCREEN16":W=5:LM=C:G
OSUB10
7170 S=2:E=7:SC$="SCREEN17":W=0:FG=TRU
E:GOSUB10
7180 S=1:E=7:SC$="SCREEN18":W=0:GOSUB1
0:GOTO7000
7999 :
8000 REM   **** PYRAMANIAC ****
8010 REM    BY ANDREW GORDON.
```

Darts

Mike Hyams,
Edgware,
Middlesex.

SPECTRUM

AT LAST YOU CAN be Eric Bristow or John Lowe on your 48K Spectrum. This version of the standard pub game has several built-in options. One or two players, 501 or 301 start, and starting with a double or straight off. When presented with the selection page you should press keys one to six to change the type of game to the one you require, and then start the game by pressing S.

Each dart throw takes place in two moves. First by stopping the radar-probe on the dartboard, and then by stopping the multiplier under the blackboard. Pressing almost any key will stop these markers, hopefully where you want them to stop. The keys with a different use are 0 and Q. 0 will drop the dart being thrown — useful for unsure players near the end of a game — and Q quits the game, returning to the title screen — useful when you have just failed your 16th attempt at double one and can't face another go.

As usual, all games must end on a double and if there are two players the winner will have a leg added to his/her score. Each set is five legs so the first to win three legs wins the set.

The alternative game, the Arcade Challenge, is so called because of its resemblance to arcade-style games rather than the traditional pub game. The computer presents you with a score which you must better with three darts. If you do not equal or beat this score then you lose one of your three lives.

The score to beat starts at 50 and rises in steps of 10 up to 150. If you survive this far then the score to beat drops back to 70, but things speed up. Only a true champion will turn through this cycle three times.

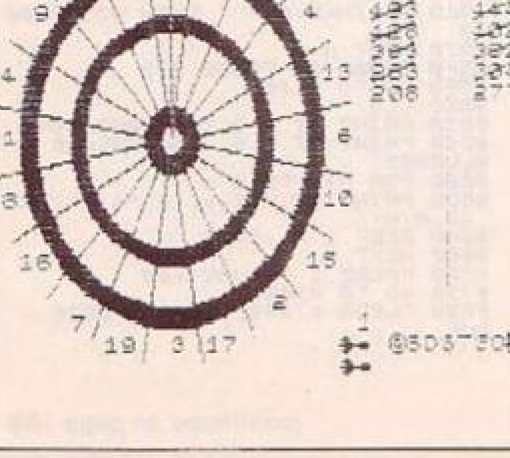
A score of 180 is rewarded with lots of buzzing and flashing, and a bonus of 500 points. A top-five high score table is presented at the end of each arcade game.

First type in listing 1, and save to tape using

SAVE "DARTS" LINE 9999

Then new the computer. Next type in listing 2. This program produces the dartboard screen and takes nearly 20 minutes to run so now is a good time to go and make a cup of coffee. When the program is finished an alarm will sound to alert you. You will be asked to prepare the cassette for saving. This should be saved directly after the Darts program.

Listing 2 takes a long time to finish but as it is only needed to produce the screen display which has now been saved, it can be discarded. The machine code used to retrieve the screen is almost instant, a slight improvement on 20 minutes.




```
  10 GO TO 9000
  20 FOR S=0 TO 255: OUT 254,S:
 OUT 254,5: NEXT S
  30 RETURN
  90 INK 0: PAPER 6
  91 PRINT AT 20,24;"@5DST50B";A
T 21,24;""
  95 OVER 1
 100 LET I=INT (RND*20)+1
 110 PLOT 89,90
 115 OUT 254,21
 120 DRAW E(I),F(I)
 130 IF INKEY$<>"" THEN GO TO 20
0
 140 PLOT 89,90
 145 OUT 254,5
 150 DRAW E(I),F(I)
 160 LET I=I+1: IF I=21 THEN LET
 I=1
 170 GO TO 110
 200 OVER 0
 201 IF INKEY$="0" THEN LET J=0:
 GO TO 300
 202 IF INKEY$="Q" THEN GO TO 91
00
 203 BEEP .25,-10
 204 LET J=INT (RND*7)+1
 205 FOR V=1 TO 50: NEXT V
 210 PRINT AT 20,24;T$(J)
 220 FOR V=1 TO WAIT: NEXT V
 230 IF INKEY$<>"" THEN GO TO 30
0
 240 LET J=J+1: IF J=9 THEN LET
 J=1
 250 GO TO 210
 300 BEEP .25,-5
 310 PLOT 89,90
 320 DRAW OVER 1;E(I),F(I)
 330 INK 7: PAPER 0
 335 LET I=I(I)
 339 IF J=0 THEN LET I=0
 340 IF J=3 THEN LET I=I*2
 350 IF J=5 THEN LET I=I*3
 360 IF J=7 THEN LET I=25
 370 IF J=1 THEN LET I=50
 380 IF J<>3 THEN LET J=3: GO TO
 400
 390 LET J=1
 400 RETURN
 999 REM ***********************
        *    CHOOSE A GAME    *
        ***********************
1000 CLS
1010 PRINT AT 1,10;"}→ DARTS }→"
1020 PRINT AT 4,8;B$(1);"1 - ONE
 PLAYER"
1030 PRINT AT 6,8;B$(2);"2 - TWO
 PLAYERS"
```

(continued on next page)

(continued from previous page)

```
1040 PRINT AT 8,8;B$(3);"3 - 501
 START"
1050 PRINT AT 10,8;B$(4);"4 - 30
1 START"
1060 PRINT AT 12,8;B$(5);"5 - DO
UBLE START"
1070 PRINT AT 14,8;B$(6);"6 - ST
RAIGHT OFF"
1080 PRINT AT 16,8;"S - START GA
ME"
1090 PRINT AT 18,4;"A - THE ARCA
DE CHALLENGE"
1100 PRINT AT 20,10; FLASH 1;"PR
ESS A KEY"
1105 FOR Z=1 TO 2000
1110 LET Z$=INKEY$
1120 IF Z$<>"" THEN GO TO 1100
1125 NEXT Z
1128 GO TO 9100
1130 IF Z$<>"1" THEN GO TO 1140
1131 LET B$(1)=C$: LET B$(2)=D$
1135 GO TO 1010
1140 IF Z$<>"2" THEN GO TO 1150
1141 LET B$(2)=C$: LET B$(1)=D$
1145 GO TO 1010
1150 IF Z$<>"3" THEN GO TO 1160
1151 LET B$(3)=C$: LET B$(4)=D$
1155 GO TO 1010
1160 IF Z$<>"4" THEN GO TO 1170
1161 LET B$(4)=C$: LET B$(3)=D$
1165 GO TO 1010
1170 IF Z$<>"5" THEN GO TO 1180
1171 LET B$(5)=C$: LET B$(6)=D$
1175 GO TO 1010
1180 IF Z$<>"6" THEN GO TO 1190
1181 LET B$(6)=C$: LET B$(5)=D$
1185 GO TO 1010
1210 IF Z$<>"A" AND Z$<>"S" THEN
 GO TO 1010
2000 REM ++++++++++++++++++++++++
         +    PLAY A GAME      +
         ++++++++++++++++++++++++
2001 LET PLAYER=1
2002 BRIGHT 0
2003 LET S1=0: LET S2=0
2004 LET L1=0: LET L2=0
2005 LET WW=0
2010 IF B$(2)=C$ THEN LET PLAYER
=2: LET WW=1
2015 IF Z$="A" THEN GO TO 5000
2020 LET START=501
2030 IF B$(4)=C$ THEN LET START=
301
2040 LET BEGIN=1
2050 IF B$(6)=C$ THEN LET BEGIN=
0
2060 LET X(1)=START
2070 LET X(2)=START
2090 LET WAIT=1
2100 RANDOMIZE USR 48000
2105 PRINT #1;"       © 1984 M. HY
AMS"
2106 INK 0: PAPER 6
2110 PRINT AT 0,24;"PLAYER"
2120 PRINT AT 2,23;"ONE";AT 3,23
; INK 7; PAPER 0;START
2121 IF WW=-1 THEN PRINT AT 4,23
; INK 7; PAPER 0;START;AT 3,23;"
"
2130 IF PLAYER=2 THEN PRINT AT 2
,29;"TWO";AT 3,29; INK 7; PAPER
0;START
2140 LET SC=4
2150 GO SUB 8000
2210 FOR N=1 TO PLAYER
2215 IF WW=-1 THEN LET WW=0: NEX
T N
2220 PRINT AT 19,21; INK 6; PAPE
R 0;"→";AT 20,21;"→";AT 21,21;
"→"
2230 PRINT AT 2,23+6*(N-1); OVER
 1; FLASH 1; BRIGHT 1;"     "
2240 INK 6: PAPER 0
2245 LET TOT=0
2250 FOR M=1 TO 3
2270 GO SUB 50
2275 LET ZZ=I
2280 IF BEGIN=0 THEN GO TO 2300
2281 IF ZZ=50 THEN GO TO 2300
2285 IF X(N)-TOT=START AND J=0 T
HEN LET ZZ=0
2300 PRINT AT 18+M,21;(" " AND Z
Z<10);ZZ
2310 LET TOT=TOT+ZZ
2311 IF X(N)-TOT=0 AND (J=1 OR I
=50) THEN GO TO 4000
2312 IF X(N)-TOT<2 THEN PRINT AT
 21,24; FLASH 1;" BUST  ": GO T
O 2330
2320 NEXT M
2330 IF X(N)-TOT>1 THEN LET X(N)
=X(N)-TOT: IF TOT=180 THEN GO SU
B 20
2360 PRINT AT SC,23+6*(N-1);X(N)
2370 PLOT 185+48*(N-1),(22-SC)*8
2375 DRAW 20,7
2380 IF SC=17 THEN FOR R=3 TO 17
: PRINT AT R,23+6*(N-1); INK 7;
PAPER 0;"    ": NEXT R: PRINT AT
3,23+6*(N-1);X(N)
2385 FOR Q=1 TO 100: NEXT Q
2390 PRINT AT 2,23+6*(N-1); OVER
 1; FLASH 0; BRIGHT 0;"     "
2400 NEXT N
2410 LET SC=SC+1
2420 IF SC=18 THEN LET SC=4
2430 LET WAIT=WAIT+.5
2500 GO TO 2210
4000 REM ++++++++++++++++++++++++
         +    WIN ROUTINE      +
         ++++++++++++++++++++++++
4010 GO SUB 20
4015 RESTORE 4080
4020 FOR M=1 TO 5
4030 READ A,B
4040 BEEP A,B
4050 NEXT M
4060 IF N=1 THEN LET L1=L1+1: IF
 L1=3 THEN LET L1=0: LET S1=S1+1
: LET L2=0
4065 IF N=2 THEN LET L2=L2+1: IF
 L2=3 THEN LET L2=0: LET S2=S2+1
: LET L1=0
4080 DATA .5,0,.25,-5,.5,0,.25,-
5,1,5
4084 IF WW=1 THEN LET WW=-1
4087 IF WW=0 THEN LET WW=1
4090 IF PLAYER=1 THEN GO TO 9100
4095 PRINT AT 20,23;"         ";
AT 21,23;"         ";AT 19,21; P
APER 5
4100 PRINT AT 20,20;"SETS  ";S1;T
AB 29;S2
4110 PRINT AT 21,20;"LEGS  ";L1;T
AB 29;L2
4120 PRINT #1;AT 0,1;"PRESS "Q"
TO FINISH THE MATCH   OR ANY OTH
ER KEY FOR NEXT LEG"
4130 IF INKEY$="Q" THEN GO TO 91
00
4140 IF INKEY$<>"" THEN GO TO 45
00
4150 GO TO 4130
4500 PAPER 5: CLS : GO TO 2000
4999 STOP
5000 REM ++++++++++++++++++++++++
         +    ARCADE GAME      +
         ++++++++++++++++++++++++
5005 DIM W(2)
5006 LET W(1)=3: IF PLAYER=2 THE
N LET W(2)=3
5010 RANDOMIZE USR 48000
5015 PRINT #1;"       © 1984 M. HY
AMS"
5016 PRINT AT 0,23;"THE";AT 1,23
;"ARCADE";AT 2,23;"CHALLENGE"
5020 PRINT AT 5,20;"HI-SCORE ";A
T 6,24;HI
5025 INK 7: PAPER 0
5030 PRINT AT 9,23;"PLAYER 1 "
5040 IF PLAYER=2 THEN PRINT AT 1
3,23;"PLAYER 2 "
5050 INK 7: PAPER 0
5060 PRINT AT 10,23;"→ → → "
5070 IF PLAYER=2 THEN PRINT AT 1
4,23;"→ → → "
5100 LET WAIT=3
5105 GO SUB 8000
5110 LET TOP=50
5200 PRINT AT 19,29;"  "
5205 PRINT AT 18,23;"SCORE TO ";
AT 19,23;"BEAT- "; FLASH 1;TOP
5300 FOR N=1 TO PLAYER
5305 IF W(N)=0 THEN GO TO 5620
5310 PRINT AT 9+4*(N-1),23; OVER
 1; FLASH 1;"         "
5330 PRINT AT 19,20;"→";AT 20,2
0;"→";AT 21,20;"→"
5390 LET TOT=0
5400 FOR M=1 TO 3
5450 GO SUB 90
5460 LET ZZ=I
5470 PRINT AT 18+M,20;(" " AND Z
Z<10);ZZ
5480 LET TOT=TOT+ZZ
5500 NEXT M
5550 IF TOT>=TOP THEN GO TO 5600
5560 BEEP .7,-10: BEEP .7,-15
5570 PRINT AT 10+4*(N-1),20+W(N)
*3;"  "
5580 LET W(N)=W(N)-1
5590 IF W(N)=0 THEN PRINT AT 10+
4*(N-1),23;"GAME OVER": BEEP .7,
-20
5595 GO TO 5610
5600 LET X(N)=X(N)+TOT
5601 IF TOT=180 THEN PRINT AT 20
,24; FLASH 1;"*BONUS* ";AT 21,24
; FLASH 1;"500 PTS ": GO SUB 20:
 LET X(N)=X(N)+500
5605 PRINT AT 11+4*(N-1),24;X(N)
5610 PRINT AT 9+4*(N-1),23; OVER
 1; FLASH 0;"         "
5620 IF W(1)=0 AND W(2)=0 THEN G
O TO 5800
5625 FOR R=1 TO 100: NEXT R
5630 NEXT N
5650 LET TOP=TOP+10
5660 IF TOP>150 THEN LET TOP=70:
 LET WAIT=WAIT-1
5680 GO TO 5200
5800 PAUSE 1: PAUSE 100
5801 FOR M=1 TO 2
5805 FOR N=1 TO 5
5810 IF X(M)>A(N) THEN GO TO 585
0
5820 NEXT N
5830 NEXT M
5835 LET HI=A(1)
5840 GO TO 9600
5850 FOR Z=5 TO N+1 STEP -1
5860 LET A$(Z)=A$(Z-1)
5865 LET A(Z)=A(Z-1)
5870 NEXT Z
5880 PRINT AT 7,3;"CONGRATULATIO
NS";AT 8,7; FLASH 1;"PLAYER ";M
5890 PRINT AT 10,3;"ENTER YOUR N
AME";AT 11,2;"FOR HI-SCORE TABLE
"
5910 INPUT FLASH 1;"NAME  ";F$
5920 LET A$(Z)=F$
5930 LET A(Z)=X(M)
5950 GO TO 5830
8000 BEEP .3,0: BEEP .3,12: BEEP
 .3,7
8010 BEEP .3,10: BEEP .3,9
8020 BEEP .3,7: BEEP .5,0
8050 RETURN
8599 STOP
9000 REM ++++++++++++++++++++++++
         +    INITIALISE       +
         ++++++++++++++++++++++++
9001 RESTORE 9000: FOR n=0 TO 23
: READ a: POKE USR "a"+n,a: NEXT
 n
9010 DATA 0,24,60,30,127,30,60,2
4,0,0,0,60,255,30,0,0,60,66,153,
165,165,153,66,60
9011 DATA 0,85,20,81,38,52,52,18
,81,20,85,0,81,20,52,38,38,52,20
,81
9012 DIM E(20): DIM F(20)
9013 FOR N=1 TO 20
9014 IF N=11 THEN RESTORE 9011
9015 READ E(N): READ F(N)
9016 IF N>5 AND N<16 THEN LET F(
N)=-F(N)
9017 IF N>10 THEN LET E(N)=-E(N)
9018 NEXT N
9020 LET hi=0
9021 DIM T$(8,12)
9022 LET T$(2)="@SDSTSOS"
9023 LET T$(3)="@SDSTSOS"
9024 LET T$(4)="@SDSTSOS"
9025 LET T$(5)="@SDSTSOS"
9026 LET T$(6)="@SDSTSOS"
9027 LET T$(7)="@SDSTSOS"
9028 LET T$(8)="@SDSTSOS"
9029 LET T$(1)="@SDSTSOS"
9030 DIM A$(5,8)
9031 FOR N=1 TO 5
9032 LET A$(N)="?????"
9033 NEXT N
9040 POKE 23658,8
9041 DATA 20,1,18,4,13,6,10,15,2
,17,3,19,7,16,8,11,14,9,12,5
9042 DIM I(20)
9043 FOR N=1 TO 20: READ I(N): N
EXT N
9050 DIM A(5)
9060 DIM B$(6,2)
9064 LET D$=CHR$ 20+CHR$ 0
9065 LET C$=CHR$ 20+CHR$ 1
9066 LET B$(1)=C$
9067 LET B$(3)=C$
9068 LET B$(5)=C$
9069 LET B$(2)=D$
9070 LET B$(4)=D$
9071 LET B$(6)=D$
9100 OVER 0: INK 0: BRIGHT 1: BO
RDER 5: PAPER 5: CLS
9101 DIM X(2)
9105 PRINT AT 2,12;"DARTS"
9110 FOR N=0 TO 21 STEP 2
9120 PRINT AT N,0;"@";AT N,31;"@
"
9130 NEXT N
9170 FOR N=-20 TO 20
9180 BEEP .01,N
9190 NEXT N
9210 BEEP 1,-20
9230 PRINT AT 4,8;"BY MIKE HYAMS
"
9240 PRINT AT 6,8;"→ © 1984 →"
9250 PRINT AT 10,5;"PRESS ANY KE[illegible]
[illegible]"
9260 PRINT AT 12,4;"OR "I" FOR I
NSTRUCTIONS"
9300 PAUSE 1: PAUSE 500
9320 IF INKEY$="I" THEN GO TO 94
00
9330 IF INKEY$<>"" THEN GO TO 10
00
9340 GO TO 9600
9400 CLS
9430 PRINT AT 0,6;"DARTS - INSTR
UCTIONS"
9435 BEEP 2,0
9450 PRINT AT 2,0;"PRESS ANY KEY
, EXCEPT "0" OR "Q"    TO STOP T
HE DART PROBE           ON TH
E BOARD"
9455 BEEP 2,5
9456 PRINT ''"    PRESS ANY KEY T
O STOP THE''"          MULTIPLIE
R": PRINT 'TAB 10;"S - SINGLE":
PRINT TAB 10;"D - DOUBLE": PRINT
 TAB 10;"T - TRIPLE": PRINT TAB
10;"O - 25": PRINT TAB 10;"@ - B
ULL"
9457 BEEP 2,10
9460 PRINT ''"   PRESS "0" TO "DR
OP" A DART      PRESS "Q" TO QUI
T THE GAME"
9470 BEEP 2,15
9480 PRINT ''"          BEAT THE SCOR
E IN THE"'" [illegible] OR
LOSE A LIFE"
9490 BEEP 2,20
9500 FOR N=-50 TO 50 STEP 3
9510 BEEP .1,N
9525 IF INKEY$<>"" THEN GO TO 96
00
9530 NEXT N
9540 PAUSE 1: PAUSE 500
9550 GO TO 9100
9600 CLS
9610 PRINT AT 2,9;"→ DARTS →"
9615 PRINT AT 4,5;"THE ARCADE CH
ALLENGE"
9620 FOR N=1 TO 5
9630 PRINT AT N*2+4,10;A$(N);TAB
 18;A(N)
9640 BEEP 1,N*-5+10
9660 NEXT N
9700 PAUSE 1: PAUSE 200
9710 GO TO 9100
9900 CLEAR 47999: LOAD ""CODE :
RUN
```

(continued on page 164)

(continued from page 162)

Program 2.

```
   1 CLEAR 47999
   5 LET pap=5
   9 PAPER 5: INK 0: BORDER 5: C
LS
  10 CIRCLE 89,90,72
  20 LET n1=18
  30 LET n2=160
  40 LET inv=1
  50 GO SUB 9000
 140 LET pap=6
 200 LET inv=0
 205 INVERSE 1
 210 CIRCLE 89,90,61
 220 LET n1=28
 230 LET n2=150
 240 GO SUB 9000
 310 LET inv=1
 320 INVERSE 0
 400 CIRCLE 89,90,48
 410 LET n1=42
 420 LET n2=137
 430 GO SUB 9000
 500 LET inv=0
 505 INVERSE 1
 510 CIRCLE 89,90,41
 520 LET n1=49
 530 LET n2=130
 540 GO SUB 9000
 600 LET inv=1
 610 INVERSE 0
 620 CIRCLE 89,90,13
 621 LET n1=77
 622 LET n2=102
 625 GO SUB 9000
 630 INVERSE 1
 631 LET inv=0
 635 LET pap=2
 640 CIRCLE 89,90,5
 650 LET n1=85
 660 LET n2=94
 670 GO SUB 9000
1000 INVERSE 0
1010 PAPER 8: INK 8
2000 FOR n=-PI/20 TO 2*PI STEP P
I/10
2010 PLOT 89+6*SIN n,90+6*COS n
2020 DRAW 80*SIN n,80*COS n
2030 NEXT n
2035 PAPER 5: INK 0
2040 PRINT AT 0,10;"20"
2050 PRINT AT 1,7;"5";AT 1,14;"1
";AT 2,4;"12";AT 2,17;"18"
2060 PRINT AT 4,3;"9";AT 4,19;"4
";AT 7,0;"14";AT 7,20;"13"
2070 PRINT AT 10,0;"11";AT 10,21
;"6";AT 13,1;"8";AT 13,20;"10"
2080 PRINT AT 16,2;"16";AT 16,19
;"15";AT 19,5;"7";AT 19,17;"2"
2090 PRINT AT 20,7;"19";AT 20,13
;"17";AT 20,11;"3"
2900 INK 7: PAPER 0
3000 FOR n=0 TO 15
3010 PRINT AT n,23;"        "
3020 NEXT n
4000 FOR n=0 TO 6911
4010 POKE n+48012,PEEK (n+16384)
4020 NEXT n
4100 RESTORE 4110
4110 DATA 1,0,27,33,140,187,17,0
,64,237,176,201
4120 FOR n=48000 TO 48011
4130 READ a: POKE n,a
4140 NEXT n
4999 PRINT #1; FLASH 1;"Prepare
cassette then press key "
5000 BEEP .5,0: IF INKEY$<>"" TH
EN GO TO 5100
5010 BEEP .5,10: GO TO 5000
5100 SAVE "screen"CODE 48000,692
1
8999 STOP
9000 FOR n=n1 TO n2
9010 FOR m=90 TO 175
9020 IF POINT (n,m)=inv THEN GO
TO 9050
9030 PLOT PAPER pap;n,m
9040 NEXT m
9050 FOR m=89 TO 0 STEP -1
9060 IF POINT (n,m)=inv THEN GO
TO 9090
9070 PLOT PAPER pap;n,m
9080 NEXT m
9090 NEXT n
9100 RETURN
```

Flash routine

Brian Allan,
Saintfield,
County Down.

DRAGON

MANY HOME MICROS have the ability to show flashing characters: the Dragon 32 is not one of them. My first program is a hex loader and a flash routine. The second gives you an idea of how this flash routine could be used. First I will explain how it works. It uses the ability to divert the timer interrupt to any machine-code routine.

The routine comes into action every 1/50th of a second. When active, the routine compares the bytes in the first graphics page to 0. For example, if location 1535 is not 0, then position 0 on the text screen flashes. This means you cannot use page 1 if the routine is active, but if page 1 of the graphics is cleared the computer will not crash because it only contains the data to see which position on the text screen to flash.

The flashing is done by adding or subtracting the value 64 from the bytes in the text screen memory. The routine is held from locations 32600 to 32677. Once the hex loader is finished you can save it as a machine-code program. Always enter Clear 200,32599 before loading it. If you do not and use text files, the data for Print #-1 or Input #-1 will overwrite the routine causing it to crash.

To use the routine, Exec 32600 switches it on while Exec 32607 switches it off. Poking location 32621 gives the speed of the flash. For example Poke 32621,50 causes a flash every second while Poke 32621,25 flashes every half second. The routine will not slow the Basic down if the flash rate is reasonable — Poke 32621, (10-255).

Lastly, for those who like to experiment with machine code, I will show them how to divert an interrupt. First, using machine code, store the address of the routine in locations 269 and 270. Then at the end of your routine, instead of an RTS, use JMP 40253.

You cannot use a lengthy routine as the computer will be impatient waiting for it to end and may crash. The reason why the address has to be stored with machine code is because Basic is too slow and will not complete the store in time for the next interupt.

```
10 REM *****************
20 REM * FLASH ROUTINE *
30 REM *  HEX.LOADER.  *
40 REM *BY BRIAN ALLAN.*
50 REM *****************
60 CLEAR 200,32599
70 CLS
80 PRINT "LOADING IN HEXADECIMAL
 CODES...":PRINT STRING$(32,"*")
;
90 FOR I=32600 TO 32677
100 READ A$:POKE I,VAL("&H"+A$)
110 NEXT I
120 PRINT:PRINT"LOADED."
130 PRINT:PRINT"'EXEC 32600' -FL
ASH ROUTINE ON."
140 PRINT"'EXEC 32607' -FLASH RO
UTINE OFF."
150 PRINT"SPEED LOCATION - 32621
."
160 DATA 8E,7F,66,BF,1.D,39,BE,9
D,3D,BF,1.D.39,7C.8,1.B6,3,1,81,
64,26,17,7F,8,1,BE,4,0.10,BE,6,0
,E6,A0
170 DATA C1,0,26,A,30,1,8C,5,FF,
23,F3,7E,9D,3D,A6,84,81,3F,23,F,
81,7F,23,4,81,BF,23,7,80,40,A7,8
4,7E,7F,80,8B,40,A7,84,7E,7F,80
180 NEW
190 END
```

```
30 REM * DEMONSTRATION *
50 REM
60 REM !! FLASH ROUTINE MUST !!
70 REM !! LOADED  & EXECUTED !!
80 REM !!      BEFORE THIS   !!
90 REM !! DEMO. IS EXECUTED. !!
100 REM
110 PMODE 0,1:PCLS 0:EXEC 32607
120 CLS
130 PRINT"FLASH DEMONSTRATION.":
PRINTSTRING$(20,"*")
140 INPUT "ENTER A SENTENCE ";A$
150 INPUT "ENTER POSITION ON SCR
EEN ";PO
160 INPUT "ENTER FLASH RATE ";FR
170 IF FR<0 OR FR>255 THEN PRINT
 "FLASH RATE OUT OF RANGE..":GOT
O 160
180 IF (PO+LEN(A$))>511 THEN PRI
NT"SENTENCE TOO LONG FOR POSITIO
N ON SCREEN...":GOTO 140
190 POKE 32621,FR
200 CLS 4
210 FOR I=PO TO PO+LEN(A$)-1
220 PRINT@I,MID$(A$,I+1-PO,1);
230 POKE 1536+I,255
240 NEXT I
250 EXEC 32600
260 GOTO 260
270 END
```

Word processor

Richard Dodd,
Caterham,
Surrey.

BBC

THIS PROGRAM HAS been designed to provide BBC users with a word processor that will perform the basic text-processing functions on a Model B with a printer but no discs. This means that the text has to be stored in RAM during processing which limits the amount of text that is able to be stored. With this in mind the program has been made as short as possible while still providing many of the features you would expect from a word processor.

This word processor has been designed to be used with an 80-column printer but can be easily changed to run on a 40-column printer.

When you run the program you will be presented with a list of 11 commands and the two letter code for each. These commands are:

Load text; Save text; Print text; Enter text; Justify text; Help; Centre on; Centre off; Count words; Exit program.

Any of these commands can be entered at any time during the program. If you press the Tab key the prompt "Next Command. . . ." will appear at the bottom of the screen. You can then enter the two-letter code for the command you want.

Load/Save: When this option is chosen you will be asked for the name of the file you wish to load or save. After loading text there will be a short wait while the number of words in the document are counted.

Edit text: If during entering text you make a mistake this command enables you to go back and edit any page you wish. When you choose this option you will first be asked if you wish to (I)nsert, (D)elete, or (R)eplace words. Next you will be asked which page you wish to edit. You can then edit the page using a cursor "+" that is moved using the four arrow keys.

Centre on/off: This command enables you to centre a complete line of text by touching the Return key. This command is useful for centering titles etc.

Help: If you forget the two letter code for one of the 11 commands entering this command or pressing the Escape key will display a list of all the commands.

Count words: After you have finished entering a document this command will

recount the number of words.

Justify: This command will line up both the left and right margins of the lines in your document by adding extra spaces.

The program, if loaded with Page set to B00, is able to store over 70 lines of text each of 80 characters. When you reach this limit the program will stop and tell you that the memory is now full up. You must then save the text or print it and then restart the program. At this point you can also edit the text but you cannot insert any extra words.

```
LIST
   10 REM ****************************************
   20 REM * WORD PROCESSOR BY RICHARD DODD *
   30 REM ****************************************
   40 MODE 3:PROCinit
   50 PROChelp
   60 PROCchoice
   70
   80 DEF PROCinit
   90 PRINT TAB(29,5);"Word Processor Program";TAB(39,
7);"By";TAB(34,9);"Richard Dodd";TAB(37,11);"For The";
TAB(31,13);"BBC model B 1.2 Rom"
  100 DIM Text$(90):FOR F%=1 TO 900:NEXT
  110 ON ERROR IF ERR>=216 AND ERR<=218 PROCerror ELSE
 GOTO 50
  120 C%=80:G%=1:W%=0:L%=0:F%=0:Y%=0:DA$="":Y%=4:E%=0:J
$="OFF":PR$="S"
  130 ENDPROC
  140 DEF PROChelp
  150 CLS:PRINT''TAB(27)"Word Processor Commands"
  160 PRINT''TAB(20);"LO...load Text        HE...help"
  170 PRINT'TAB(20 "SA...save Text        CO...Centre O
n"
  180 PRINT'TAB(20 "PR...print Text       CF...centre o
ff"
  190 PRINT'TAB(20 "EN...enter Text       X...exit prog
ram."
  200 PRINT'TAB(20 "ED...edit Text        WO...Count Wo
rds"
  201 PRINT'TAB(20 "JU...Justify Text"
  210 PRINT'TAB(20)"            (TAB)   Change Mode"
  220 PRINT TAB(28,22);"Any Key To Continue":C$=GET$:C
LS:ENDPROC
  230 DEF PROCenter
  240 PRINT TAB(0,3);J$;"---------1---------2---------3--
--------4---------5---------6---------7---------8"
  250 PRINT TAB(0,Y%);Text$(L%)
  260 PRINT TAB(0,Y%+1);STRING$(C%,"*");A$="":A%=0:GOT
O 280
  270 A%=GET:IF Y%>20 THEN CLS:S%=S%+1:PRINT TAB(0,4);
CA$:Y%=4:GOTO 240
  280 IF L%=72 PROCfull ELSE PRINT TAB(0,1);"  Page =
 ";S%;TAB(35,1);"Words = ";W%;TAB(65,1);" Lines = ";L%

  290 IF A%=9 GOTO 330 ELSE IF A%=127 PROCdelete
  300 IF A%=13 AND J$="OFF" PROCreturn ELSE IF A%=13
PROCcenter
  310 IF A%>31 AND A%<127 PROCtext
  320 GOTO 270
  330 ENDPROC
  340 DEF PROCtext
  350 PRINT TAB(F%,Y%);CHR$(A%)
  360 Text$(L%)=Text$(L%)+CHR$(A%):F%=F%+1
  370 IF A%>31 AND A%<48 AND ASC(MID$(Text$(L%),F%-1,1
))<>32 AND ASC(MID$(Text$(L%),F%-1,1))<>A% W%=W%+1
  380 IF F%=C% PROCcarry
  390 ENDPROC
  400 DEF PROCcarry
  410 PROCbar
  420 E%=C%+1:REPEAT:E%=E%-1:UNTIL MID$(Text$(L%),E%,1
)=" " OR E%=0
  430 Text$(L%+1)=MID$(Text$(L%),C%-E%):Text$(L%)=LE
FT$(Text$(L%),E%-1)
  440 PRINT TAB(0,Y%);Text$(L%)+STRING$(C%-LEN(Text$(L
%))," ");Text$(L%+1)
  450 L%=L%+1:Y%=Y%+1:F%=LEN(Text$(L%)):E%=0:ENDPROC
  460 DEF PROCcenter
  470 IF F%=0 ENDPROC
  480 F%=INT(40-(LEN(Text$(L%))/2))
  490 Text$(L%)=STRING$(F%," ")+Text$(L%)+STRING$(F%,"
 ")
  500 PRINT TAB(0,Y%);Text$(L%):Y%=Y%+1:F%=0:PROCbar:Y
%=Y%+1
  510 F%=0:ENDPROC
  520 DEF PROCdelete
  530 IF F%-1<0 ENDPROC
  540 PRINT TAB(F%,Y%);CHR$(A%):F%=F%-1:Text$(L%)=LEF
T$(Text$(L%),F%)
  550 E%=ASC(MID$(Text$(L%),F%-1,1)):IF E%>31 AND E%<4
8 AND ASC(MID$(Text$(L%),F%-2,1))<>32 AND ASC(MID$(Tex
t$(L%),F%-2,1))<>E% W%=W%-1
  560 ENDPROC
  570 DEF PROCreturn
  580 Text$(L%)=Text$(L%)+STRING$(C%-F%," "):F%=0:PROC
bar:Y%=Y%+1
  590 L%=L%+1:ENDPROC
  600 DEF PROCbar
  610 PRINT TAB(0,Y%+1);STRING$(C%," ");TAB(0,Y%+2);ST
RING$(C%,"*");TAB(0,Y%+1);:ENDPROC
  620 DEF PROCprint
  630 Y%=3
  640 PRINT TAB(0,4);:IF PR$="P" CLS:FOR F%=0 TO L%:PR
INT Text$(F%):NEXT:CLS:GOTO 660
  650 PRINT TAB(0,4);:FOR F%=(S%-1)*17 TO L%:PRINT TAB
(0,Y%+1);Text$(F%):Y%=Y%+1:NEXT:F%=LEN(Text$(L%))
  660 F%=0:ENDPROC
  670 DEF PROCsave
  680 *FX139,1,0
  690 INPUT TAB(10,23);"Enter File Name....";Name$
  700 IF Name$="" CLS:GOTO 690 ELSE C%=OPENOUT Name$
  710 FOR F%=0 TO L%:PRINT £C%,Text$(F%):NEXT
  720 CLOSE £C%:F%=0:C%=0:ENDPROC
  730 DEF PROCload
  740 Y%=4:L%=0
  750 INPUT TAB(10,23);"Enter File Name....";Name$
  760 F%=OPENIN Name$
  770 REPEAT
  780 INPUT £F%,Text$(L%)
  790 L%=L%+1:Y%=Y%+1:IF Y%=21 THEN S%=S%+1:Y%=4
  800 UNTIL EOF£F%
  810 CLOSE £F%:L%=L%-1:F%=0:F%=LEN(Text$(L%)):ENDPROC
  820 DEF PROCerror
  830 IF ERR=216 OR ERR=217 OR ERR=218 THEN PRINT"Data
 LOADING error":PRINT"Reposition Tape":PRINT"Any Key T
o Continue LOADING"
  840 M$=GET$
  850 CLOSE £F%
  860 CLS:PROCload:ENDPROC
  870 DEF PROCedit
  880 F%=0:G%=0:H%=0:I%=0:J%=0:K%=0
  890 INPUT TAB(10,23);"Editing Mode  (R)eplace/(I)nse
rt/(D)elete ";M$
  900 IF INSTR("RrIiDd",M$)=0 CLS:GOTO 890
  910 IF M$="I" OR M$="i" THEN IF L%>=70 PROCfull
  920 CLS:PRINT TAB(0,2);"Editing Mode...";M$
  930 INPUT TAB(10,23);"Page To Be Edited....";F%:IF F
%>S% OR F%=0 CLS:GOTO 920
  940 G%=(F%-1)*17:H%=0:I%=4:Y%=4:*FX4,1
  950 IF F%<>S% PRINT TAB(0,2);STRING$(C%,"*");Y%=2:
PRINT TAB(0,4);:FOR J%=G% TO G%+16:PRINT TAB(0,J%-G%+4
);Text$(J%):NEXT:GOTO 970
  960 PRINT TAB(0,4);:FOR J%=(S%-1)*17 TO L%:Y%=Y%+1:P
RINT TAB(0,Y%-1);Text$(J%):NEXT:F%=LEN(Text$(L%))
  970 A%=GET
  980 IF A%=9 AND M$<>"R" PROCjust:GOTO 1030 ELSE IF
A%=9 GOTO 1030
  990 IF A%>135 AND A%<140 PROCcursr
 1000 IF A%>31 AND A%<127 PROCchange
 1010 IF H%<80 AND H%>-1 THEN PRINT TAB(H%,I%)"*"
 1020 GOTO 970
 1030 IF Text$(K%+1)<>"" AND K%+1>L% L%=L%+1
 1040 ENDPROC
 1050 DEF PROCcursr
 1060 CU$=MID$(Text$(G%+I%-4),H%+1,1):PRINT TAB(H%,I%)
;CU$
 1070 IF CU$="" PRINT TAB(H%,I%);" ":IF H%-1>1 A%=136

 1080 IF A%=136 AND H%-1>-1 H%=H%-1
 1090 IF A%=137 AND H%+1<C% H%=H%+1
 1100 IF A%=138 AND I%+1<Y% I%=I%+1
 1110 IF A%=139 AND I%-1>3 I%=I%-1
 1120 ENDPROC
 1130 DEF PROCchange
 1140 IF M$="R" OR M$="r"PROCreplace
 1150 IF M$="D" OR M$="d"PROCdel
 1160 IF M$="I" OR M$="i"PROCinsert
 1170 ENDPROC
 1180 DEF PROCreplace
 1190 IF H%+1>C% ENDPROC
 1200 IF MID$(Text$(G%+I%-4),H%+1,1)="" ENDPROC
 1210 PRINT TAB(H%,I%);CHR$(A%):IF I%-4=L% Text$(G%+I%
-4)=LEFT$(Text$(G%+I%-4),H%)+CHR$(A%)+MID$(Text$(G%+I%
-4),H%+2,F%) ELSE IF I%-4<>L% Text$(G%+I%-4)=LEFT$(Tex
t$(G%+I%-4),H%)+CHR$(A%)+MID$(Text$(G%+I%-4),H%+2,C%)
 1220 H%=H%+1:F%=F%+1:ENDPROC
 1230 DEF PROCdel
 1240 IF LEN(Text$(G%+I%-4))<=0 ENDPROC
 1250 IF I%-4=L% Text$(G%+I%-4)=LEFT$(Text$(G%+I%-4),H
%)+MID$(Text$(G%+I%-4),H%+2,F%) ELSE IF I%-4<>L% Text$
(G%+I%-4)=LEFT$(Text$(G%+I%-4),H%)+MID$(Text$(G%+I%-4)
,H%+2,LEN(Text$(G%+I%-4)))
 1260 PRINT TAB(0,I%);Text$(G%+I%-4);" "
 1270 ENDPROC
 1280 DEF PROCinsert
 1290 IF I%-4=L% Text$(G%+I%-4)=LEFT$(Text$(G%+I%-4),H
%)+CHR$(A%)+MID$(Text$(G%+I%-4),H%+1,LEN(Text$(G%+I%-4
))) ELSE IF I%-4<>L% Text$(G%+I%-4)=LEFT$(Text$(G%+I%-
4),H%)+CHR$(A%)+MID$(Text$(G%+I%-4),H%+1,LEN(Text$(G%+
I%-4)))
 1300 H%=H%+1:PRINT TAB(0,I%);LEFT$(Text$(G%+I%-4),C%)
:ENDPROC
 1310 DEF PROCjust
 1320 K%=0
 1330 REPEAT
 1340 G%=LEN(Text$(K%))+1:REPEAT:G%=G%-1:UNTIL MID$(Te
xt$(K%),G%,1)<>" "
 1350 IF K%=L% AND G%<=80 ENDPROC ELSE IF G%<=80 GOTO
1420
 1360 Text$(K%)=LEFT$(Text$(K%),G%)
 1370 H%=E%:REPEAT:H%=H%-1:UNTIL MID$(Text$(K%),H%,1)=
" "
 1380 I%=E%:CA$=MID$(Text$(K%),H%+1,LEN(Text$(K%)))+"
":Text$(K%)=LEFT$(Text$(K%),H%-1)
 1390 REPEAT:S$=MID$(Text$(K%+1),G%,1):G%=G%-1:UNTIL S
$<>" "
 1400 Text$(K%+1)=CA$+Text$(K%+1):G%=LEN(Text$(K%+1))+
1:REPEAT:S$=MID$(Text$(K%+1),G%,1):G%=G%-1:UNTIL S$<>"
 "
 1410 Text$(K%+1)=LEFT$(Text$(K%+1),G%):IF LEN(Text$(K
%+1))<=C% ENDPROC
 1420 K%=K%+1
 1430 UNTIL FALSE
 1440 DEF PROCspace
 1450 JU$="":IF H%=40 GOTO 1500
 1460 I%=0:REPEAT:I%=I%+1:UNTIL MID$(Text$(F%),I%,1)<>
" "
 1470 FOR J%=I% TO LEN(Text$(F%)):IF MID$(Text$(F%),J%
,1)=" " AND MID$(Text$(F%),J%-1,1)<>" " AND H%>0 THEN
JU$=JU$+"  ":H%=H%-1:NEXT ELSE JU$=JU$+MID$(Text$(F%),
J%,1):NEXT
 1480 Text$(F%)=JU$:IF H%>0 JU$="":GOTO 1470
 1490 Text$(F%)=STRING$((I%-1)," ")+Text$(F%)
 1500 ENDPROC
 1510 DEF PROCchoice
 1520 *FX4,0
 1530 INPUT TAB(10,23)"Next Command...";Ch$:Ch$=LEFT$
(Ch$,2)
 1540 IF Ch$="LO" OR Ch$="lo" PROCload:PROCcount:CLS:P
ROCprint:PROCenter
 1550 IF Ch$="SA" OR Ch$="sa" PROCsave:CLS:PROCprint:P
ROCenter
 1560 IF Ch$="PR" OR Ch$="pr" PR$="P":VDU 3,2:PROCprin
t:VDU 3,0:PR$="S"
 1570 IF Ch$="EN" OR Ch$="en" CLS:PROCprint:PROCenter
 1580 IF Ch$="ED" OR Ch$="ed" PROCedit:CLS:PROCprint:P
ROCenter
 1590 IF Ch$="HE" OR Ch$="he" PROChelp:CLS:PROCprint:P
ROCenter
 1600 IF Ch$="CF" OR Ch$="cf" J$="OFF":PROCenter
 1610 IF Ch$="CO" OR Ch$="co" J$=" ON":PROCenter
 1620 IF Ch$="WO" OR Ch$="wo" PROCcount
 1630 IF Ch$="JU" OR Ch$="ju" PROCjust2:PROCprint
 1640 IF Ch$="X" OR Ch$="x"THEN END
 1650 PRINT TAB(10,23);STRING$(70," ");
 1660 GOTO 1530
 1670
 1680 DEF PROCfull
 1690 CLS
 1700 PRINT TAB(29,5);"The Memory is now full";TAB(25,
7);"Please Dump To Tape Or Printer";TAB(29,9);"And Sta
rt Program Again"
 1710 GOTO 1530
 1720 DEF PROCcount
 1730 W%=0
 1740 FOR F%=0 TO L%
 1750 FOR G%=1 TO C%:A%=ASC(MID$(Text$(F%),G%,1)):IF A
%>31 AND A%<48 AND ASC(MID$(Text$(F%),G%-1,1))<>32 AND
 ASC(MID$(Text$(F%),G%-1,1))<>A% W%=W%+1
 1760 NEXT:NEXT:PRINT TAB(35,1);"Words = ";W%
 1770 F%=0:G%=0:ENDPROC
 1780 DEF PROCjust2
 1790 FOR F%=0 TO L%-1
 1800 IF MID$(Text$(F%),C%,1)=" " GOTO 1830
 1810 H%=C%-(LEN(Text$(F%))):PROCspace
 1820 PROCspace
 1830 NEXT:F%=0:G%=0:ENDPROC
```

Instring

CBM-64

Ralf Bergs,
Gummersbach-Windhagen,
Germany.

THE ROUTINE is called by the USR-function. The brackets of the USR-function hold the string expression you are searching for. The string expression which shall be examined must be added with an "&" sign. For example:

P=USR("BOARD")&"KEYBOARD"

results in P=4. If the string which was searched for is not found, P is equal to 0.

When started the key-click program asks for the address at which the machine-code shall begin. The program then protects the machine code from being overwritten by Basic. You start the program with SYS ADR where ADR is the location at which the machine-code begins.

Whenever you press Run/Stop and Restore together, the machine is reset and the key-click program is switched off. To restart it use SYS ADR.

Instring.

```
9 REM (C) 1984 BY R. BERGS, GERMANY
10 A=PEEK(55):A=A-81:IF A<0 THEN A=A+256:POKE 56,PEEK(56)-1
11 POKE 55,A:CLR:REM PROTECT M/C FROM BASIC
12 A=PEEK(55)+PEEK(56)*256
13 FOR I=0 TO 80:READ B:POKE A+I,B:NEXT
14 POKE 0,76:POKE 1,PEEK(55):POKE 2,PEEK(56):REM INSTALL USR-JUMP
15 END
16 REM FULLY-LOCATIBLE M/C-PROGRAM
17 DATA 32,163,214,133,183,134,187,132,188,32,121,0,201,38,240,3,76,8,207,32
18 DATA 115,0,32,158,205,32,130,215,240,48,200,132,100,164,183,240,41,165,34,208
19 DATA 2,198,35,198,34,198,100,165,100,197,183,176,4,160,0,240,21,230,34,208
20 DATA 2,230,35,232,164,183,136,177,187,209,34,208,228,136,16,247,138,168,76,16
2,21
```

Key click.

```
10 INPUT"START LOCATION OF M/C";AN
11 FOR I=AN TO AN+45:READ D:POKE I,D:NEXT
12 IRQ=AN+13:HI=INT(IRQ/256):LO=IRQ-HI*256
13 POKE AN+2,LO:POKE AN+7,HI
14 HI=INT(AN/256):LO=AN-HI*256
15 PRINT"BEEP  SYS"AN
16 POKE 55,LO:POKE 51,LO:POKE 56,HI:POKE 52,HI:NEW
17 DATA 120,169,221,141,20,3,169,27,141,21,3,88
18 DATA 96,169,0,141,14,144,141,12,144,165,203,197
19 DATA 158,133,158,240,14,201,64,240,10,169,200,141
20 DATA 12,144,169,15,141,14,144,76,191,234
```

AMSTRAD *Competition* RESULTS

JUNE'S COMPETITION offered two prizes, as the first prize an Amstrad CPC-464 which comes with a colour monitor, and as the second the same machine with a monochrome monitor. All you had to do to enter was place eight features of computer games in order of preference. For a tie-breaker we also asked you to think of an original title for a computer game.

To pick what was to be the winning order we assembled a panel of hardened games players. Between them they brought years of arcade experience to bear on the problem. In effect their task was to define the ingredients of a best-selling game.

As it turned out it proved almost impossible to reach an agreement. For example, everyone on the panel agreed that high-resolution graphics deserved a place near or at the top of the list, but what about realism? Surely realism in a game and high-res graphics amount to the same thing? On the other hand several of the most successful games have a cartoon style which is far from realistic — and so the argument continued.

One judge wanted to give easy loading priority on the grounds that without it a game is unplayable. But most games load without any trouble; this would seem to be more a precondition for playing games rather than a favourite feature.

Our final decision was a compromise. You probably will not agree with it exactly but it broadly reflects the preference of our panel and, indeed, of most of the entries: 1. High-resolution graphics. 2. Sound effects. 3. Different screens. 4. Quick reactions. 5. Realism. 6. Problem solving. 7. Easy loading. 8. User definable controls.

Two contestants came up with the same list as our judges. We awarded the first prize to Michael Burdass, 6 Town Hill, Broughton, Near Brigg, South Humberside. His title, Pea Pod Pete, was thought to be more appealing than AKA — Death, which was suggested by the second prizewinner, Carl Chippendale, 93 Common Road, Huthwaite, Sutton-in-Ash, Nottingham.

A look at the rest of the entries — almost 2,000 of them — turned up some highly entertaining titles. Anagram makers went to town on the name Amstrad and sent in, by the dozen, Mad Star or Mad Rats. More original were C Robinson's surreal Underpants in Space, D Walker's topical Picket Panic — a sequel to Manic Miner — and R Avery's mystifying Catbird Ten Twenty.

From A Karhumaki in Finland came The Rise of the Patriotic People of Finland against the Military Power of Imperialism and for the Sprouting Independence of their Nation; while from Spain E Diaz suggested Crazy Bullfight. C Oakes almost matched the Finnish entry in length with Revenge of the 90 Foot High, Pan Dimensional, Laser Spitting, Kamikaze, Combat Hamsters.

There were many others deserving of a mention. Here's a small selection from them: Jet Lag Willy, Tebbit Attack, Stomplicator, Boku Boku the Exterminator, Lost in Tesco's, Armadillo Nights, Cambridge Clive and the Temple of Delays, Tutencarman, Attack on Amstradam, Bunfight at Theo Kay's Corral, Half a Worn-out Toothbrush Bristle, Invasion of the Killer Odour Eaters.


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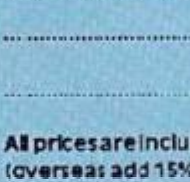
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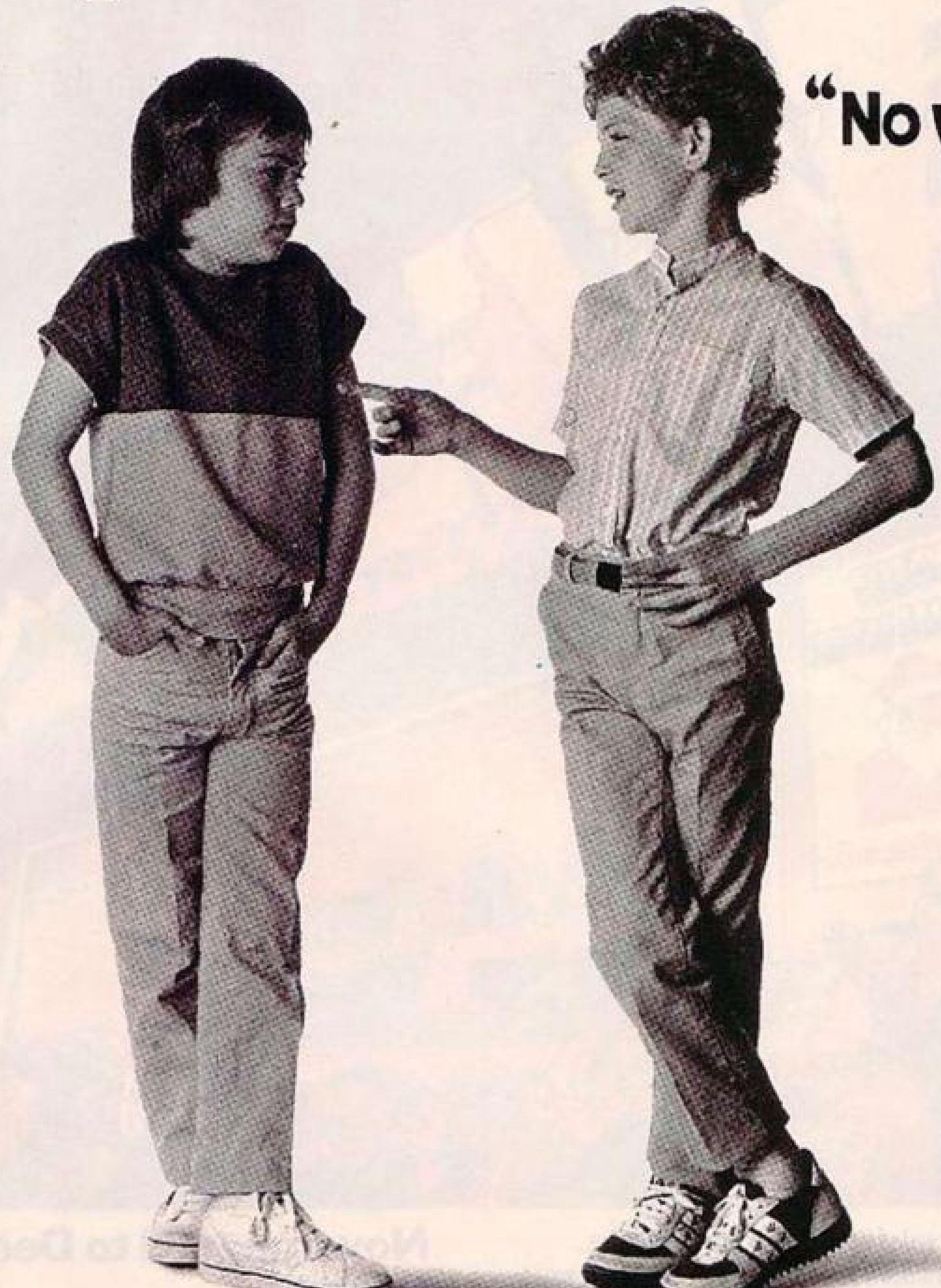
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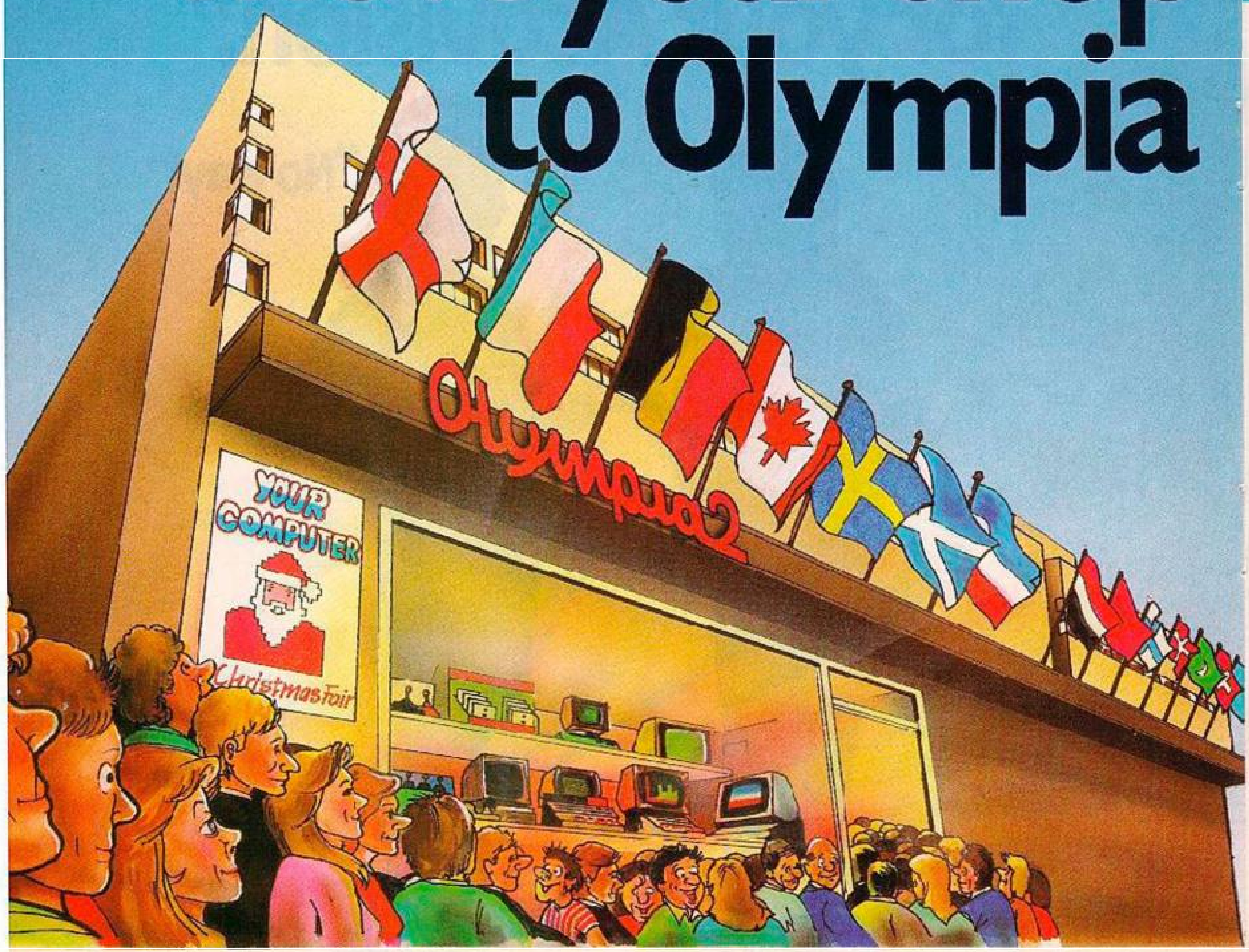
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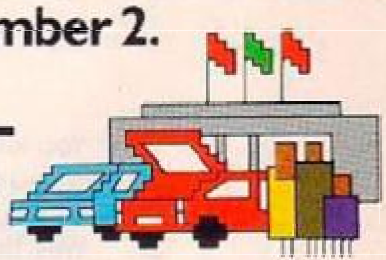
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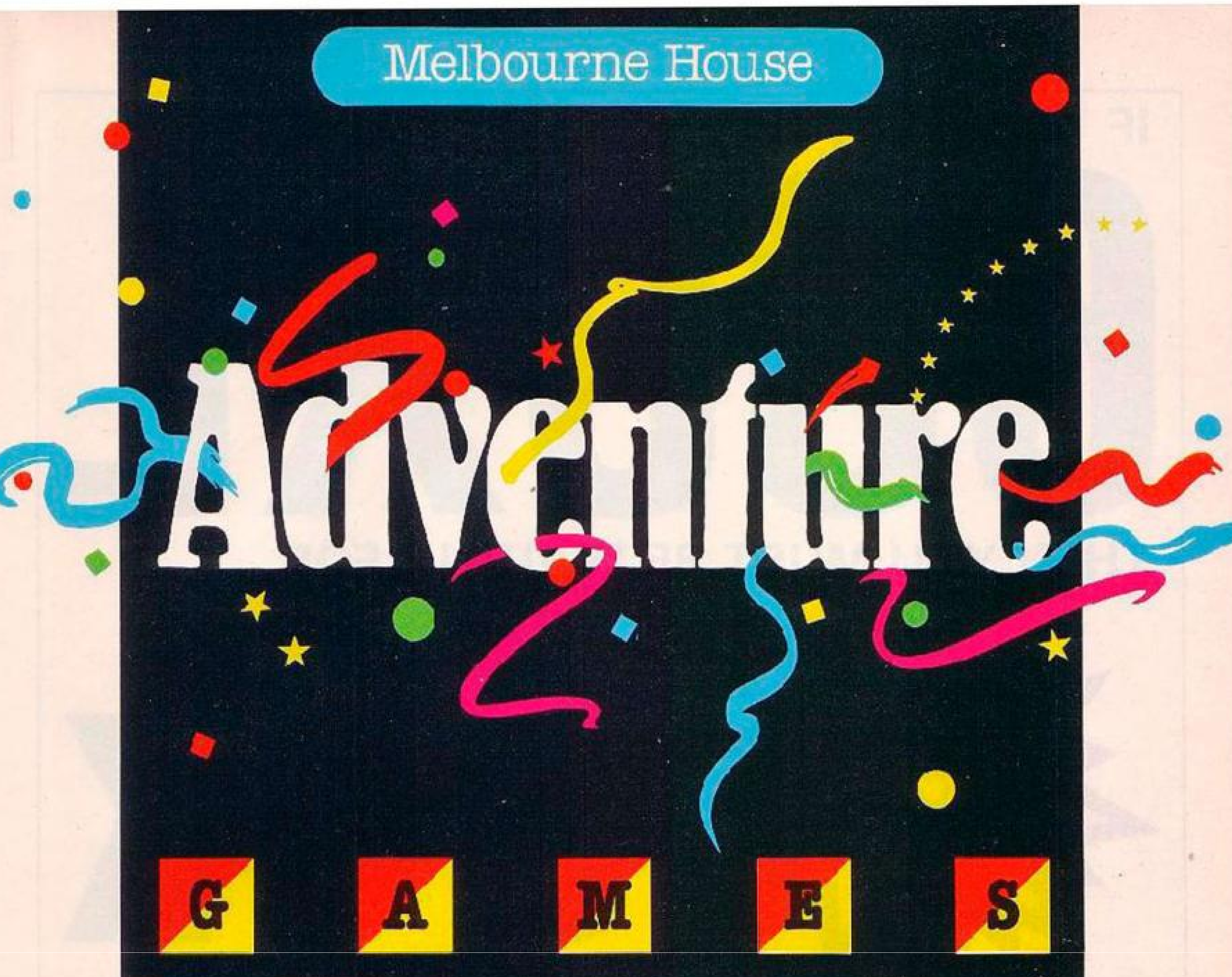
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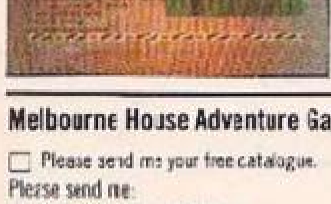
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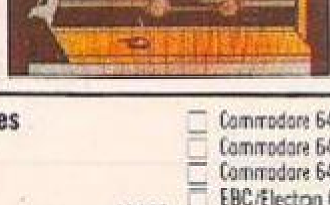
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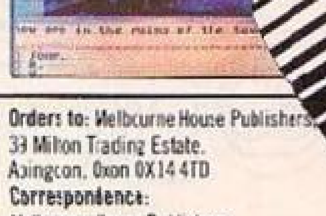
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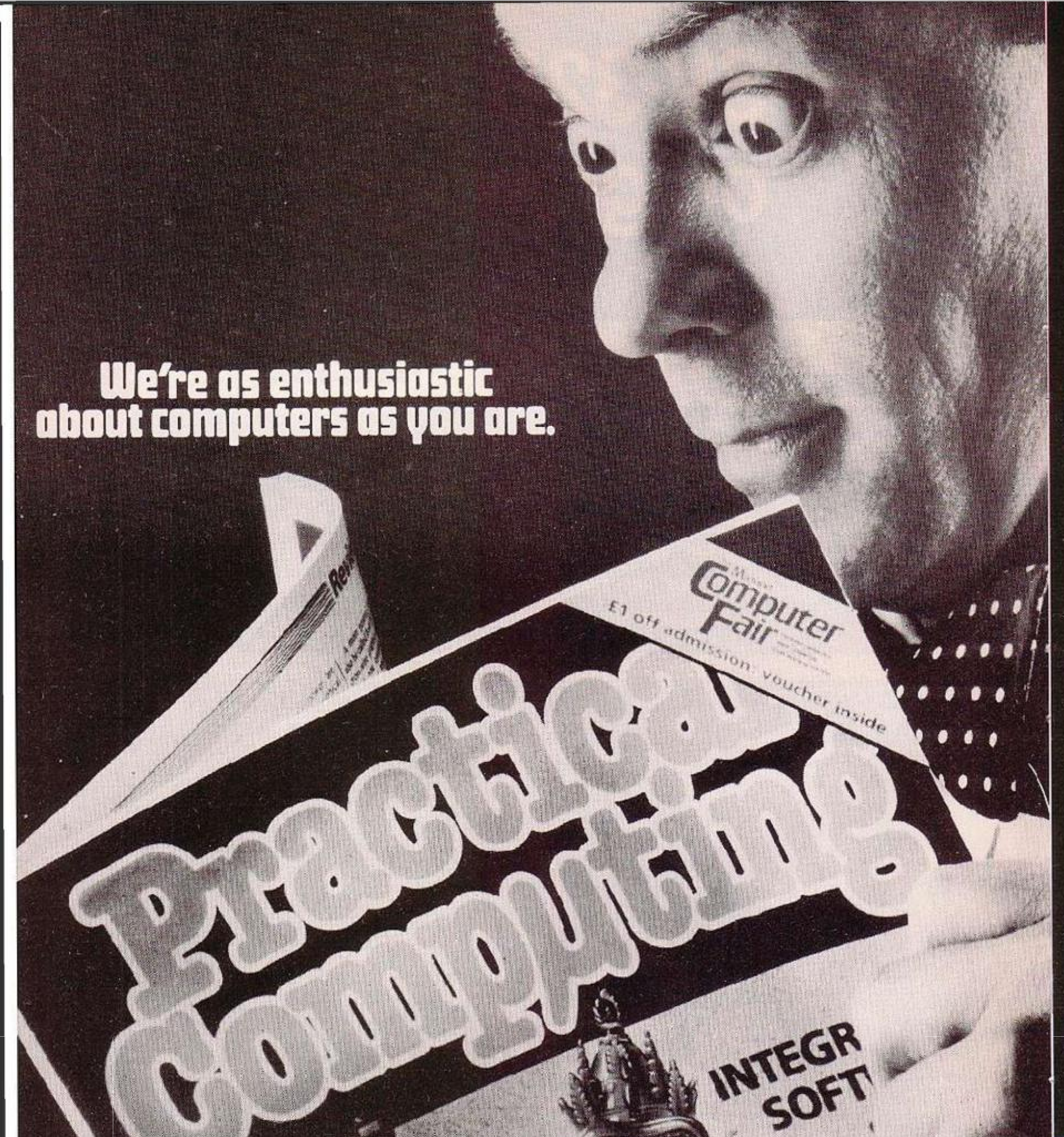
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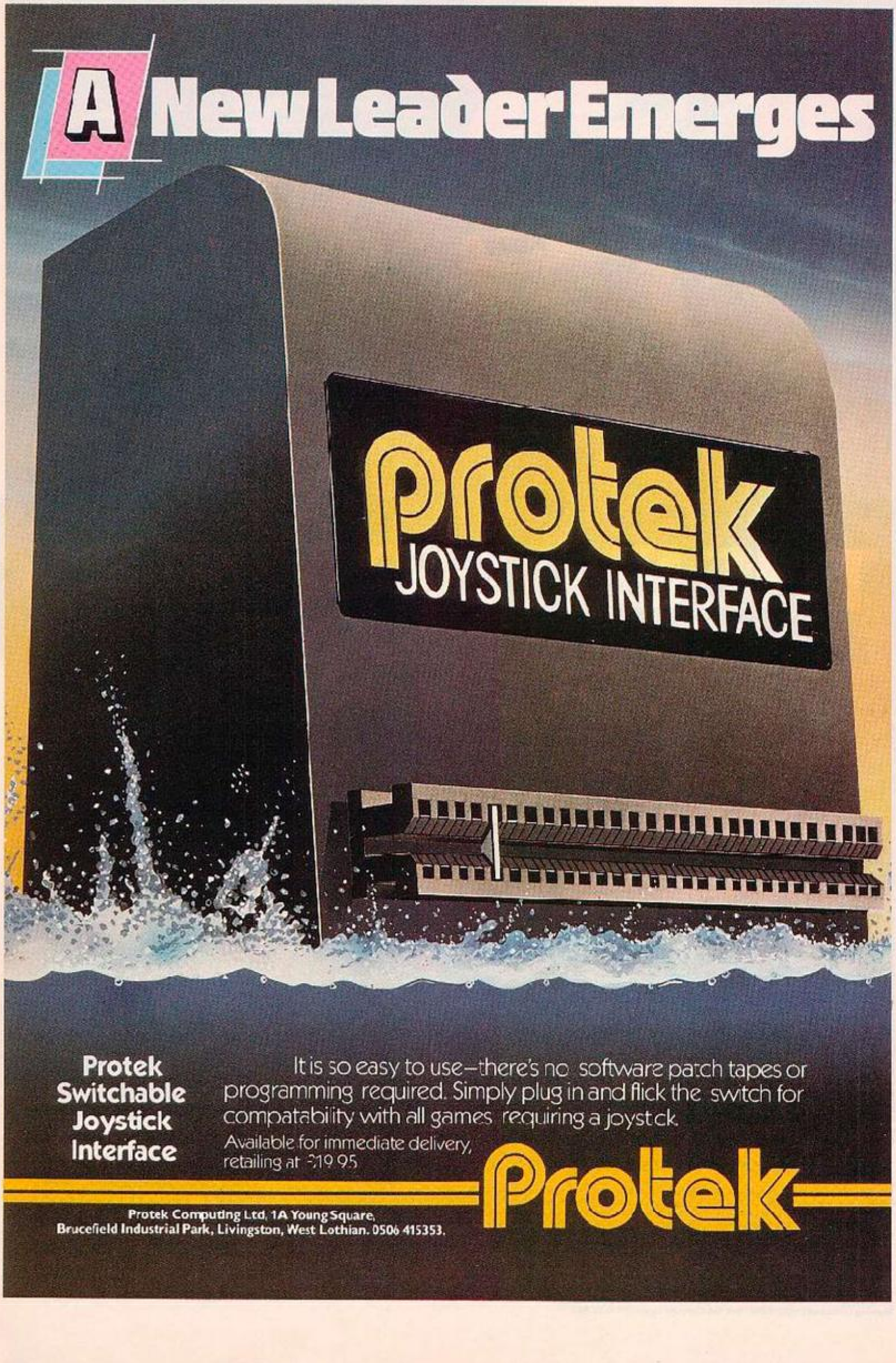


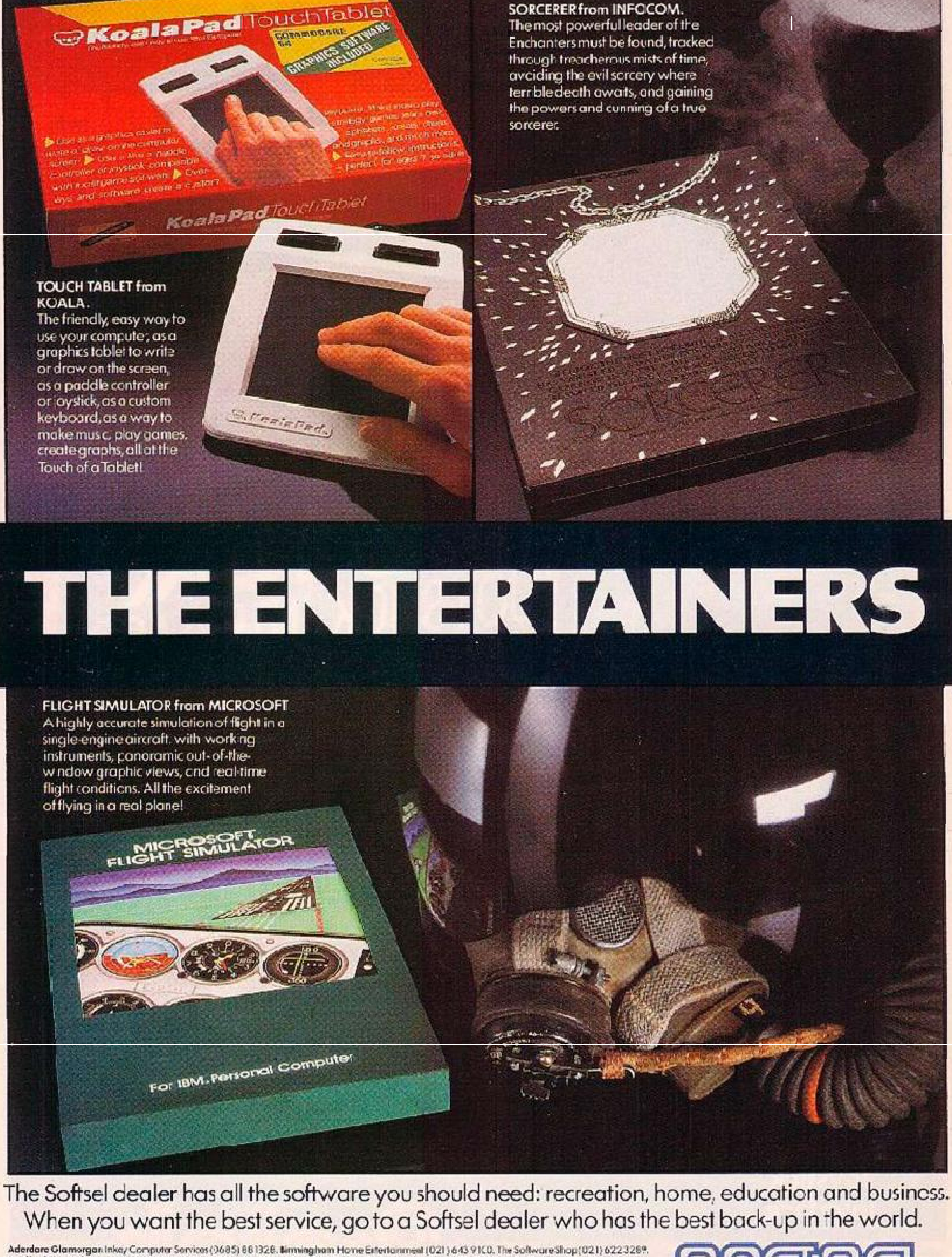
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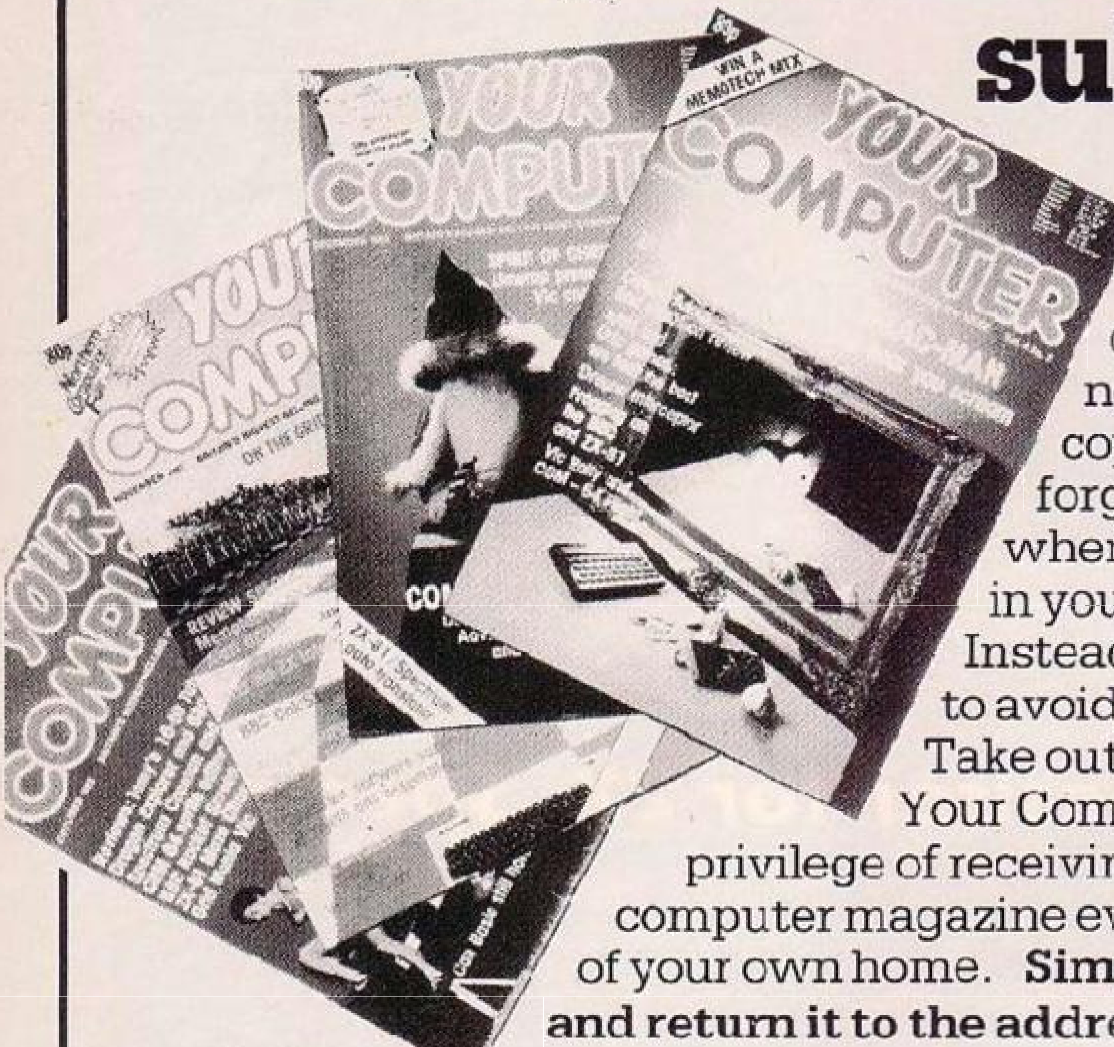
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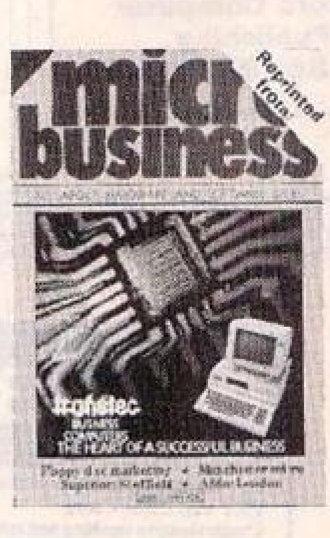
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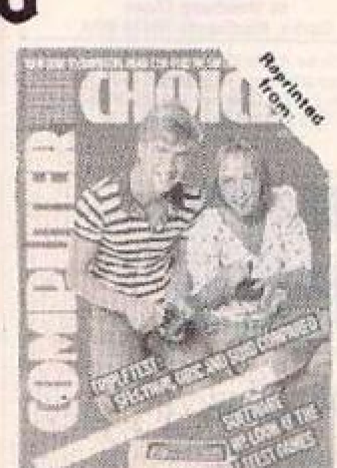
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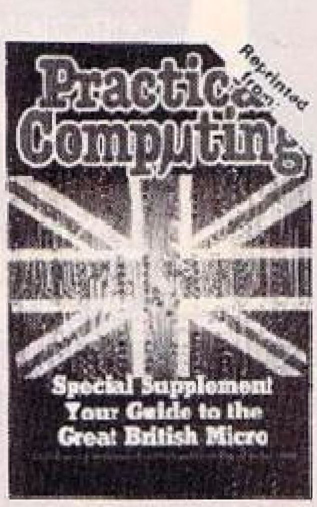
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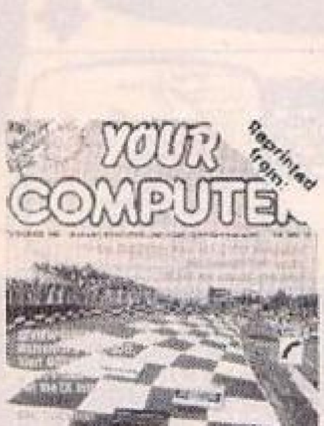
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Adventure Games Exhibition

On the Board, Computer and Role-playing adventure games exhibition. September 1-2 is Games Day at the Royal Horticultural Hall. More details from Games Workshop, 27-29 Sunbeam Road, London NW10. Telephone 01-965 3713.

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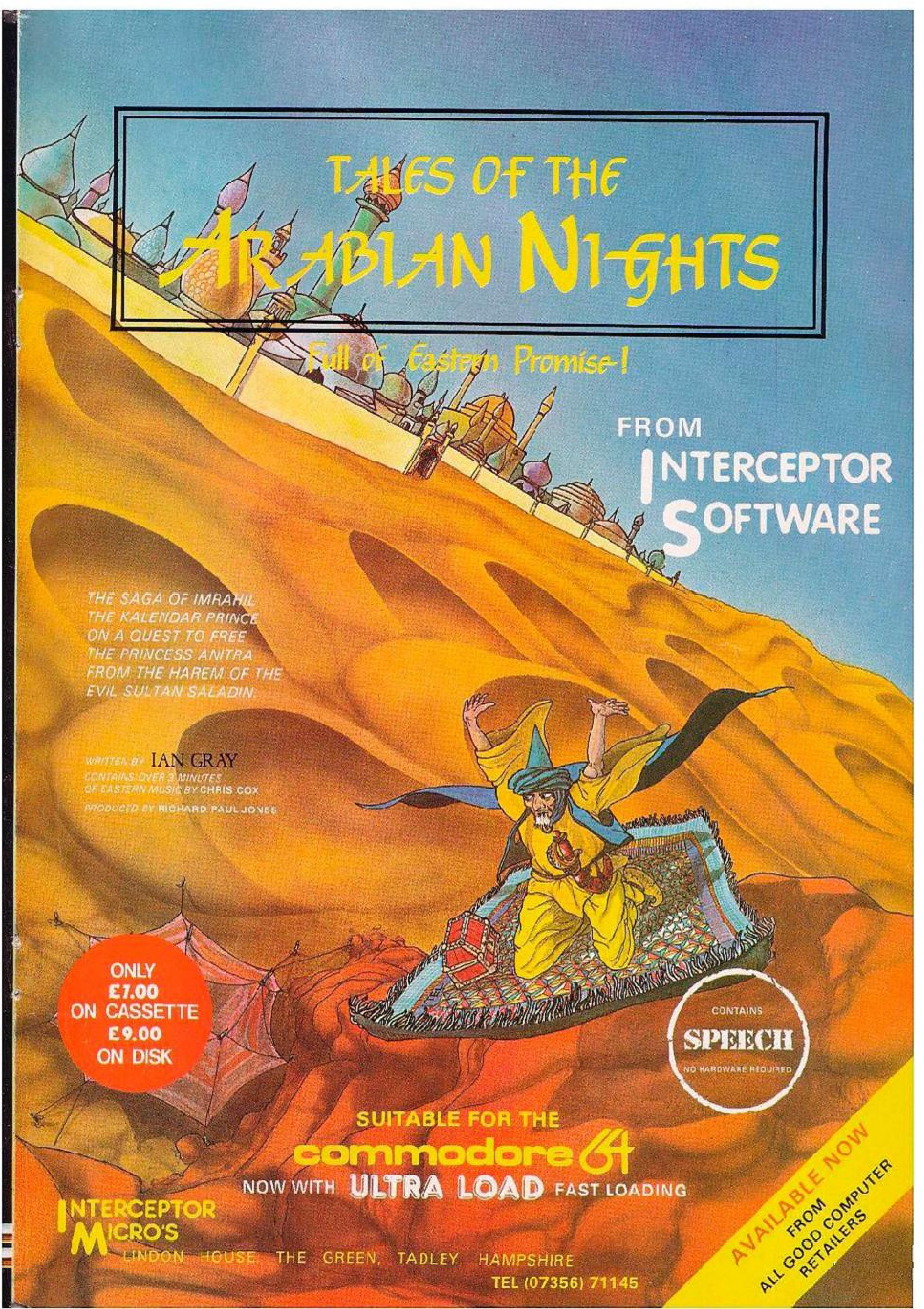


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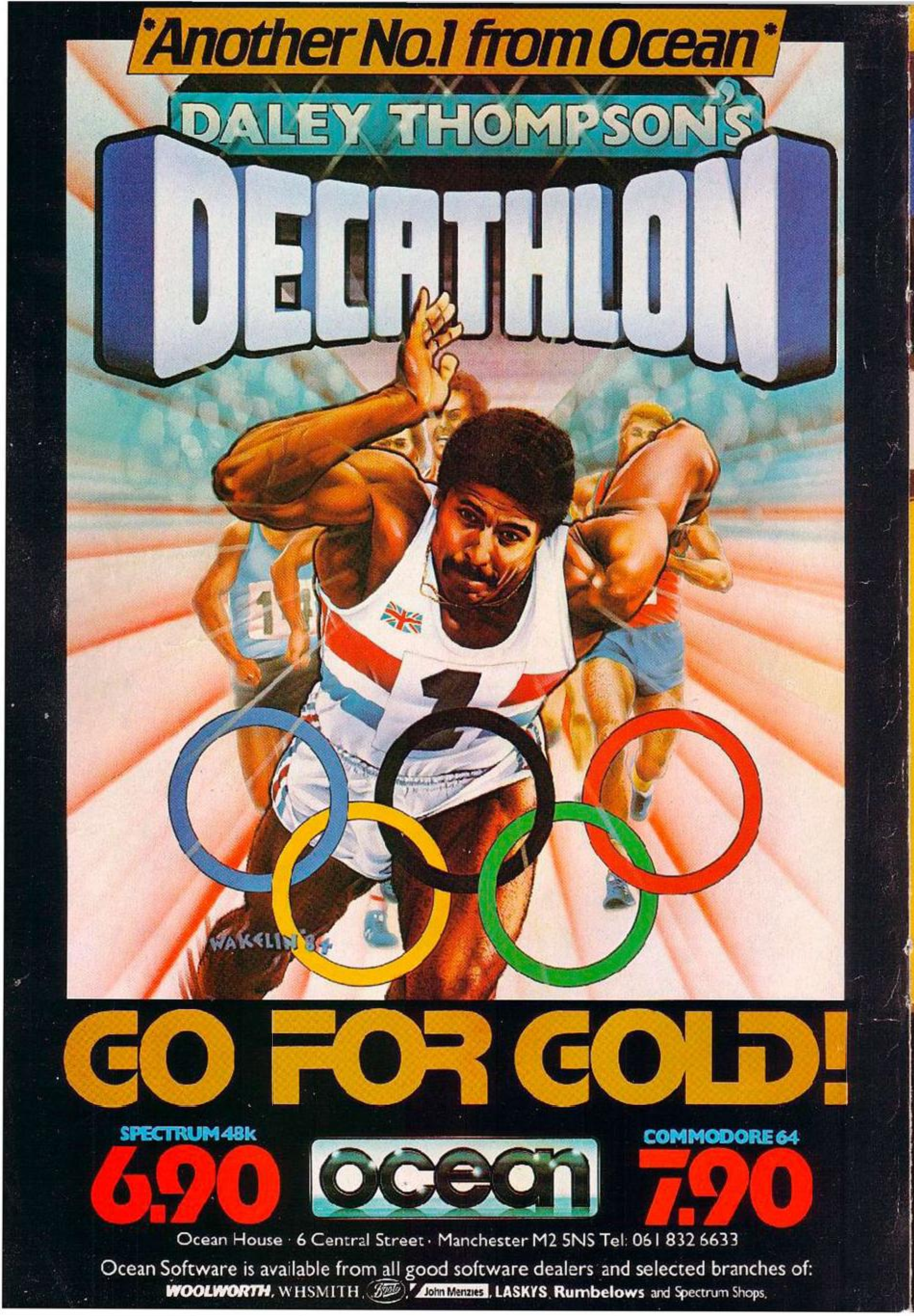
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